PEST CONTROL

MARCH 1958

CDC Report

For '58 on Pesticides of Public Health Importance Covers Mosquitoes, Flies, Fleas, Roaches, Bed Bugs, Ticks, and Rodents Pg. 9

Accent on Wood Gnawers Brings Record Turnout to Purdue Conference Pg.30

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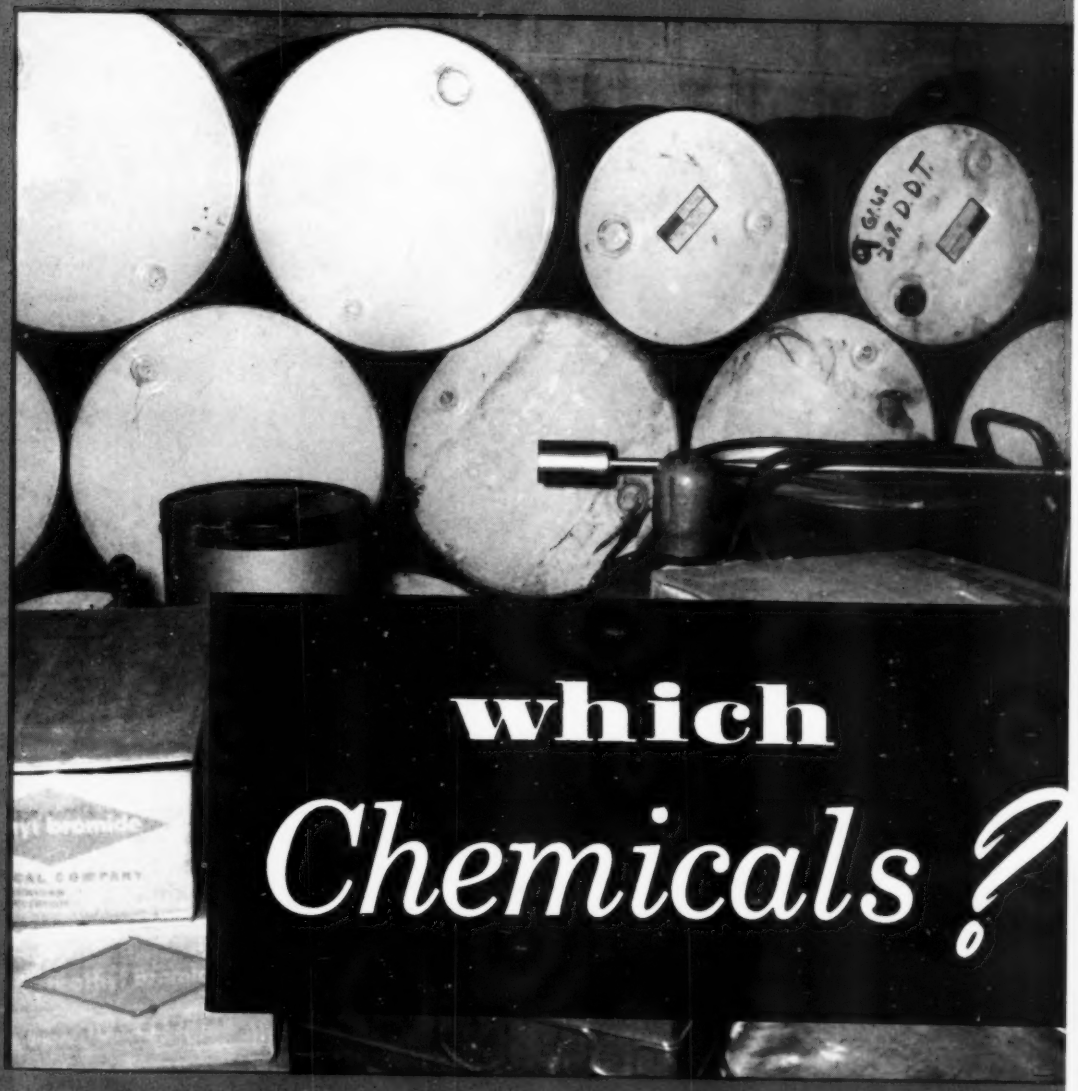

The big question mark confronting the pest control industry today pertains to chemicals—which ones are effective against resistant insects, yet safe to use. Part of the answer will be found in the 1958 report of the Communicable Disease Center, outlining results of that agency's intensive research during the past year with pesticides of public health importance. See pg. 9.

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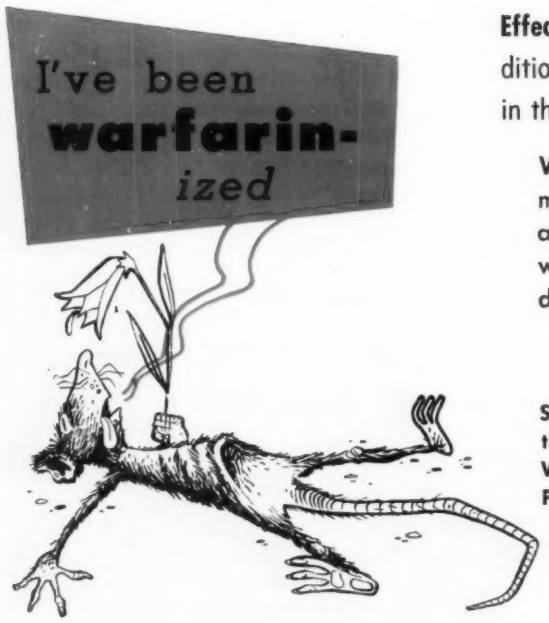

Send your technical questions concerning the use of warfarin bait to:
Wisconsin Alumni Research Foundation,
P. O. Box 2217, Madison 1, Wisconsin.

Wisconsin Alumni Research Foundation

Missiles, Chemicals and PCOs

In this age of rockets and missiles, little surprises us any more. But we have learned, one can't let many days go by without stopping to read to keep informed on new fields scientists have conquered.

As one country is forced by its adversaries to actively engage in scientific research just to stay ahead, so must the pest control industry keep up its relentless war against the insects.

We can't rest for a minute. Researchers explain how insects develop immunity to chemicals PCOs use on the firing line, but the "enemy" continues to find ways to outmaneuver every control tactic.

At each of the several PCO conferences held so far this year, there were reports of research that's developing more effective control weapons. Some are new chemicals in the chlorinated hydrocarbon and phosphate groups. And another group of pesticides, the carbamates, has been announced for introduction this year to take over where there is suspected resistance to present-day chemicals. One university speaker even predicted PCOs would use an insect's own hormones in the battle against him.

The quantity of pesticides used by the pest control industry has become so significant that an increasing number of large chemical firms are keeping their research laboratories busy to find answers to our resistance problems.

A pest control operator must keep alert to these developments or he may be lost. Often the difference between profit or loss, in a market area where price competition is keen, is the proper use of new, more effective pesticides that do the job quicker.

Structural pest control is becoming more technical than ever. But every announced discovery must be regarded in the proper perspective. Each has use limitations as well as advantages. Judgment must guide their use to avoid contamination where toxicity may jeopardize the food we eat, the air we breathe, or the goods we use. That's why you must know and take advantage of sound recommendations for pesticide use such as those issued annually by the Communicable Disease Center of the U. S. Public Health Service and published each year in *Pest Control*. You'll find the '58 suggestions start on page 9 in this issue.

Chemicals are the PCO's ammunition, but they're not of much value if battle plans are not based upon well-established control principles. Nevertheless, you do have to keep alert to new developments so you can make proper use of them when Federal registration eventually puts them at your disposal.

1933 OUR SILVER ANNIVERSARY YEAR 1958

PEST CONTROL

FIRST MONTHLY SINCE 1933

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Volume 26 **March, 1958** **No. 3**

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Letters

No American Cyanamid 3124

I would like to refer you to the October, 1957 issue of *Pest Control*, page 26b, and the article entitled "Review of Newer and Experimental Pesticides."

In the table, there are listed two American Cyanamid compounds, namely 4124 and 3124. We do not have a chemical 3124, and both materials should be 4124. I am bringing this to your attention since we have received inquiries concerning 3124 reported in the article.

F. Ray Barron, Jr.

Chief Entomologist
Phosphates and Nitrogen Division
American Cyanamid Co.
New York, N.Y.

Praises PC Bookshelf

Congratulations to you on a very excellent article *("PCO's Two-Foot Bookshelf," Dec. pg. 12)* and for listing the reference books that each PCO should have on hand for constant and continuing reference.

We have some of these books in our present library and are taking immediate steps to acquire those others which you recommend and which we now do not have.

Our sincere appreciation for this very fine article.

W. H. Trunick

Arab Termite & Pest Control, Inc.
Indianapolis, Ind.

Defines Diphacin, diphacinone

In the August 1957 (pg. 14) issue of *Pest Control*, you published an article entitled "Diphacin, New Anticoagulant Rodenticide."

Some confusion has arisen since the publication of this article on the proper use of the terms Diphacin and diphacinone. Our present wishes with respect to the use of these words are as follows:

Diphacinone is a contraction of the chemical name of the toxicant, 2-diphenylacetyl-1,3 - indandione. Diphacinone is being used as a common name to designate the pure chemical compound.

Diphacin is a dry bait containing 50 ppm of diphacinone. The term Diphacin is to be used to designate the single product currently being sold in the retail market.

I would appreciate your publishing as much of this letter as you feel is desirable to make a matter of record the inconsistencies which exist between the presentation which we took in the article published in August and our current usage of the terms.

Dr. Robert L. Gates

Research Department
Niagara Chemical Division, FMC
Middleport, N.Y.

Israel Requires PCO Exam

It may be of interest to your readers to know that the Israel Ministry of Health now requires that all PCOs pass a professional examination in order to obtain a license.

In preparation for this examination, a course was organized by the Israel Pest Control Operators' Association in cooperation with the Vector Control Section of the Ministry of Health.

PCOs may choose any or all of the following fields for examination, and licenses are then limited to the examined fields: rodent control, including rodenticides and rodent ecology; fumigation including fumigants, techniques, toxicology, regulations, and first aid; and insect control, including insecticides, toxicology, and insect biology.

Two examinations have already been given and all district health offices and municipalities have been given the names of those PCOs who have passed and in which field they are authorized to work. Upon request from the public, a copy of this list is supplied from which an operator may be chosen.

This regulating and the concomitant lifting of standards of service was welcomed not only by the health authorities but by most PCOs as well.

Norman G. Gratz

Director, Vector Control Section
Ministry of Health, Jerusalem, Israel

January Rat Story Error

Even with the most careful attention to detail, errors will creep in. I have just been informed by our grounds chief that our article on "Rat Extermination in Pittsburgh's Lower Hill" (Jan. '58, pg. 23) contains an error in the stated strength of Warfarin.

Apparently our staff technicians who gave me the technical information to be included in the article have been misreading the labels. The strength of Warfarin used is not 5% but 0.5%, which is obviously a considerable difference.

Wilson S. Borland

Research Analyst
Housing Authority of the City of Pittsburgh
Pittsburgh, Pa.

More Anniversary Greetings . . .

In the capacity as President of the National Pest Control Association, and also in behalf of my own company I would like to express to you my sincere congratulations on the 25th birthday of *Pest Control.*

As I travel throughout the country, I find that *Pest Control* is on the desks of people throughout our industry. We in the business especially appreciate the help, assistance, and cooperation that you have given us, and commend you for your publication.

I am sure with the guidance of you and your fine staff that your magazine will continue to be the outstanding publication that it has developed into.

J. C. Redd

Redd Pest Control Co.
Jackson, Miss.

* * * *

Somehow, somewhere along the line, I completely overlooked a very important event in the life of *Pest Control* magazine — its Silver Anniversary! Whatever the reason for the oversight, I am sure you know that it is not a lack of appreciation for the magazine. On the contrary, I have nothing but the highest praise for the magazine, its editors, publisher, and others concerned. I am always very much

Pest Control welcomes expressions of opinions from its readers. Send ideas and comments as briefly as possible to James A. Nelson, Editor, Pest Control, 1900 Euclid Avenue, Cleveland 15, Ohio.

impressed by the terrific creative ability you folks continually display in being able to make every issue of *Pest Control* attractive and informative. In fact, most issues of the magazine seem to demand attention.

Let me offer my congratulations to you, Jim, and to Phil Osborne, and the rest of your staff and best wishes for continued success in your good work.

R. J. Kowal

Chief, Division of Forest Insect Research
Southeastern Forest Experiment Station
U. S. Forest Service
Asheville, N. C.

* * * *

I notice you are celebrating your 25th anniversary and wish to add my congratulations to those of your other well wishers for having completed such a useful period, in what I expect will be a long and valuable career. Your magazine has served a need for the pest control industry and has been most helpful to many of us in the Government.

Justus C. Ward

Head, Pesticide Regulation Section
Plant Pest Control Division, ARS
Washington, D.C.

* * * *

May I add my congratulations, although somewhat belatedly, to the list of those who have already written you on the occasion of *Pest Control's* Silver Anniversary.

We thought you might like to know that even the "peddlers" fully enjoy your fine publication. Here's hoping you will have many, many more successful years with *Pest Control.*

William A. Eichler

Prentiss Drug & Chemical Co., Inc.
Chicago, Ill.

* * * *

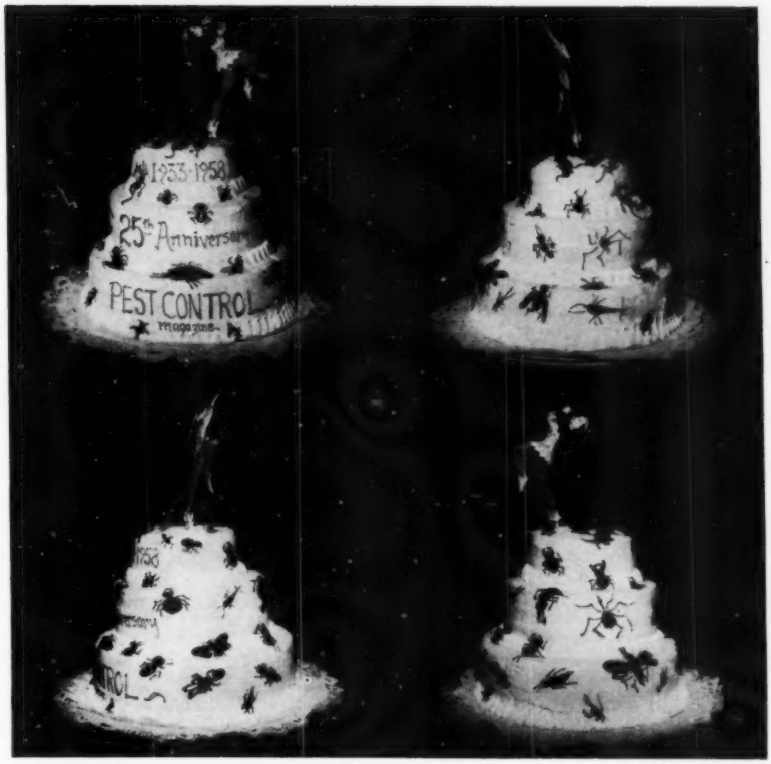
We take this opportunity of wishing you our warmest congratulations on the Silver Anniversary of *Pest Control.*

Pest Control is an important medium between the American and European pest control industry owing to its scientific contents and most interesting articles.

We wish you an increasing success and steady growing results.

W. R. v. Hennekeler

Bogena N. V.
Rotterdam, Holland



Not so appetizing; but a work of art! That's what witnesses said of PC's 25th Anniversary cake on January's cover. This four-view picture shows no two confectionery insects were alike.

The Cake

Many subscribers have written to ask for details on the cake pictured on the cover of Pest Control's Silver Anniversary Issue in January.

As far as can be determined, it is the only cake of its kind ever to have been so decorated with authentic-looking rodents and insects made entirely of frosting. It was baked to order by Hough Bakeries, Inc. in Cleveland and decorated by a talented cake artist, John Waskawicz, a Navy veteran trained at a Chicago cake decorating school. He has been at his art for about ten years.

The only instructions given Hough Bakeries were to provide us with a cake using the Pied Piper motif on top and a few insects on the sides. Waskawicz used his ingenuity and did a little research by looking into the Encyclopedia Britannica to get lifelike miniature rats, spiders, roaches, flies, termites, silverfish, scorpions, etc. Each had the correct number of body segments, leg muscles, antennae; in fact it was almost as if an entomologist had directed the work. The whole assignment was completed in two days. Waskawicz told us he had never done anything quite like it before.

No two of the mice or insects were alike. They were so realistic several of the wives of *Pest Control* staffers refused to eat any part which had a "pest' on it. The cake was so unusual, the bakery carried a picture of it in its own company magazine with the caption, "A graphic cake that speaks for itself."

Our cameraman took the pictures shown here of all sides of this unique anniversary cake to illustrate the decorator's skill.

Pest Control celebrated the 25th anniversary of its founding with a special dinner at Hotel Statler where the cake was served for dessert (it was delicious, too) and then the party attended the Cleveland Playhouse to see, appropriately enough, "The Mousetrap" by Agatha Christie, which luckily was playing in town during January.

Editor

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1958 Report from the Communicable Disease Center

PUBLIC HEALTH PESTICIDES[1]

for mosquitoes, flies, fleas, roaches, bed bugs, ticks, rodents

From the Communicable Disease Center, Public Health Service, U. S. Department of Health, Education and Welfare, Savannah, Georgia

PUBLIC HEALTH PESTICIDES is an annual release prepared by the Communicable Disease Center on the current status of the chemical control of pests of public health significance. The information presented is based on investigations conducted by the Technology Branch, Communicable Disease Center, supplemented by data from the literature and from unpublished material provided by other research organizations.[1] Particular emphasis is placed upon those pesticides which, under test or field conditions, have provided the highest level of control and are compatible with human safety. Such a summation precludes the consideration of all chemicals capable of exerting suppressive effects upon the pests discussed. In addition, data on experimental compounds as yet unavailable for public usage are omitted. Information on such compounds may be obtained by writing to the Technical Development Laboratories, Communicable Disease Center, Box 769, Savannah, Georgia. In this annual review, control measures which remained unchanged from those recommended in 1957 may be restated verbatim.

Chemical control measures are discussed as they relate to groups of arthropods or to rodents. While discussion of the toxicological phase of the various control measures is limited, detailed coverage of this aspect is given in a companion release "Clinical Memoranda on Economic Poisons." A third release "Operational Memoranda on Economic Poisons" considers each toxicant in relation to its overall use in the control of arthropods and rodents of medical importance. Copies of the latest revisions of these memoranda (April 1956) can be obtained by writing to the Communicable Disease Center at the address previously given.

In applying any of the measures subsequently discussed, it should be recognized that each is merely a tool designed to reduce the animal or insect population to a point where it no longer is a detriment to the well being of the individual or community. The efficiency of an individual measure depends entirely upon the way in which it is used, not only in relation to environmental factors, but also to the biology of the species concerned. In some instances one technique may provide adequate control; in other cases application of several methods may be necessary (e.g., house fly control: sanitational improvement supported by space and residual insecticidal treatments). Frequently, faulty control derives from the application of the procedure, not from the technique *per se*.

At present, the greatest hindrance to chemical control of arthropods is the ability of certain species to develop resistance to a pesticide to the extent that it fails under field conditions. Whether the control failure is due to resistance or to other factors (faulty toxicant, poor application techniques, etc.) can be determined by measuring the susceptibility level of the species to the toxicant before and during control operations. Where pretreatment susceptibility data are not available, recourse may be made to comparison of the susceptibility levels of the species in treated and untreated zones. Fortunately detailed laboratory tests are not an essential to the detection of resistance under field conditions. Information on available methods for the field detection of resistance in public health pests can be obtained by writing the Communicable Disease Center.

While insecticide applications against both larval and adult stages of an insect provide maximum reduction of the insect, the continued use of these control techniques enhances the chance of a rapid development of resistance in the population. This enhancement arises from the increased selection pressure which is placed upon an insect population when both developmental and adult stages are exposed to the toxicant. In addition, treatment of the developmental stage alone exposes the population in "concentrated" density in contrast to the relatively "dispersed" state of adult densities; larvicides thereby exert maximum selection pressure.

In mosquito control operations

1. Particular acknowledgment is made to the Entomology Research Branch, U. S. Department of Agriculture(A); to the Florida State Board of Health, Bureau of Entomology(B); and to the California Department of Public Health, Bureau of Vector Control (C); for providing certain unpublished experimental data for inclusion in this resume. All references in text to these organizations are by small capital letters as indicated above.

DDT and other chlorinated hydrocarbon insecticides may serve as effective adulticides even when resistance renders their use of questionable value in the reduction of larval infestations. To lessen the chances that larvicidal treatments will decrease the efficacy of the same or related toxicant as an adulticide, previous releases have indicated that where larvicides are required, organophosphorus compounds should be employed for that purpose to avoid development or acceleration of resistance to chlorinated hydrocarbon insecticides by the mosquito population, thus making possible longer effective use of the latter group of pesticides against the adults.

However, laboratory studies by several investigators now show that susceptible house fly strains selected for resistance to parathion or Diazinon have developed high levels of resistance to DDT, dieldrin, and other chlorinated hydrocarbon insecticides, even though not exposed to any of the latter compounds. From these data, it is apparent that the use of organophosphorus larvicides may not prevent the development of, or the increase of, resistance to chlorinated hydrocarbon toxicants in the insect population under field conditions. Nonetheless, until evidence is available from field operations to validate or invalidate this possibility, this procedure is considered the method of choice when both chemical larvicidal and adulticidal operations are necessary. Whenever possible, larviciding operations should be avoided in favor of permanent measures such as sanitation, drainage, etc. Where organophosphorus larvicides are utilized, measurement of the resistance levels of the adult insects to chlorinated hydrocarbon insecticides should be made in conjunction with the use of the latter pesticides in adulticiding operations.

Throughout the major part of this release, the dosage of toxicant employed is expressed as technical material in terms of milligrams per square foot, pounds per acre, or parts per million. The dosage of the toxicant applied is dependent upon the concentration of the formulation used, together with the rate at which the material is dispersed. Thus, a 1 percent formulation sprayed on a surface at the rate of 1 gallon per 500 square feet provides a dosage in milligrams per square foot equivalent to the treatment of 1000 square feet with 1 gallon of a 2 percent formulation. The choice in selecting the concentration of a formulation is influenced by the coverage necessary, type of surface, toxicity of the pesticide, transportation requirements, and the equipment available. Certain of the formulation strengths required to give specific dosages are listed in tables 1 and 2. Methods for preparation of dusts, solutions, etc. of varying concentrations are outlined in the Operational Memoranda on Economic Poisons issued by the Communicable Disease Center.

Table 1. Number of gallons of finished spray of varying concentrations required to produce specific dosages of toxicant in milligrams per square foot.

Percent concentration of formulation	Gallons of spray required per 1000 sq. ft. to give:			
	200 mg./sq. ft.	100 mg./sq. ft.	50 mg./sq. ft.	20 mg./sq. ft.
5.0	1.0	0.5	0.25	0.1
2.5	2.0	1.0	0.50	0.2
1.0	5.0	2.5	1.25	0.5
0.5	10.0	5.0	2.50	1.0
0.25	20.0	10.0	5.00	2.0

Table 2. Number of pounds of dusts of varying strengths required to produce specific dosages of toxicant per acre.

Percent concentration of dust	Pounds of dust required per acre to give toxicant dosage of:				
	2 lb./A	1 lb./A	0.5 lb./A	0.2 lb./A	0.1 lb./A
5.0	40	20	10	4	2
3.0	66	33	16	7	4
2.0	-	50	25	10	5
1.0	-	-	50	20	10
0.5	-	-	-	40	20

Although this resume emphasizes the chemical methods of arthropod control, it should not be assumed in error that these procedures are the principal techniques to be used in operational programs. In any such program, environmental sanitation is the key to successful abatement, since where no attempt is made towards the reduction of the availability of suitable breeding habitats, chemical control procedures alone may yield disappointing results. Permanent control measures, such as reduction of mosquito breeding sites (by drainage, filling, etc.) or the improvement of environmental sanitational levels in a community for fly control (proper storage and disposal of garbage, etc.) are a basic tenet for accomplishing arthropod control. Conversely, it is true that while the insecticidal means are subordinate to adequate sanitational measures, maximum abatement usually cannot be achieved without chemical aids, either as a supplemental or emergency phase. While the above comment is true for arthropod control, the same does not apply to disease control since the latter can and has been accomplished in some countries with pesticides alone by affecting only a segment of the insect population (i.e., mosquito vectors entering habitations). As a further control axiom, the control operator should, for maximum abatement of a vector, utilize the various pesticides and procedures available to him rather than

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building the entire chemical control phase around a single chemical or technique. Thus while residual applications may provide suitable fly control for extended periods, the most efficient manner of coping with emergency infiltration of heavy fly populations may be with space spray treatments. Likewise, in some cases, larvicidal treatments may prove advantageous in reducing fly population levels to a point where other methods (residual treatments, space sprays) can maintain adequate control.

MOSQUITO CONTROL

Resistance to insecticides by mosquitoes is widespread, not only in species which are disease vectors but also in those chiefly important from an annoyance standpoint. Confirmed instances of physiologic resistance have been reported for 17 species, nine of which occur in North America, thus giving this region a greater number of resistant strains than occurs in any other geographic zone. Resistance among the 6 anopheline species is chiefly to DDT or to dieldrin (and related toxicants) with little evidence to date of cross resistance to these two compounds in any species except *Anopheles sacharovi*.

In the United States physiologic resistance to chlorinated hydrocarbon insecticides has been detected in *Aedes dorsalis*, *A. nigromaculis*, *A. sollicitans*, *A. taeniorhynchus*, *Anopheles quadrimaculatus*, *Culex pipiens*, *C. tarsalis*, *Psorophora confinnis*, and *P. discolor*. Unconfirmed reports also indicate resistance to DDT in *C. quinquefasciatus* and current studies at Savannah, Georgia, with this species show field collected adults to have little susceptibility to residues of either DDT or dieldrin. In general the substitution of organophosphorus compounds for chlorinated hydrocarbon toxicants has provided effective control of resistant culicine strains. However, in the Fresno Mosquito Abatement District of California, the application of a malathion larvicide for 2½ years resulted in the development of resistance to that pesticide in both adults and larvae of *C. tarsalis*. No resistance was apparent in *A. nigromaculis* in the same area nor did either species show any change in its susceptibility to parathion. In another abatement district which has used EPN and parathion for 5 years, *C. tarsalis* and *A. nigromaculis* continue to be susceptible to parathion and malathion. These data again indicate the variability in resistance patterns as influenced by species and/or pesticide. Whether the absence of resistance to parathion in these species after such extensive usage can be interpreted as an indication that mosquitoes develop resistance to it slowly or not at all remains to be determined.

Larvicides

In the absence of resistance to the chlorinated hydrocarbons, anopheline or culicine larvae can be controlled by use of DDT-fuel oil solutions at a rate of 0.05 to 0.2 pound of toxicant per acre. Against DDT-resistant larvae, dieldrin, chlordane, heptachlor, or lindane at 0.1 pound of toxicant per acre can be employed. If these dosages are ineffective in situations where fish and other wildlife are not involved (sewage lagoons, borrow pits), application rates can be doubled or quadrupled.

Where mosquito strains are resistant to chlorinated hydrocarbon insecticides in general, the organophosphorus toxicants are the pesticides of choice. Against *C. tarsalis* and *A. nigromaculis* larvae, malathion and parathion at maximum rates of 0.5 and 0.1 pound per acre respectively, have been the principal toxicants employed.

These same toxicants also are being used against larvae of *A. taeniorhynchus* and *A. sollicitans* in southeastern United States. In Florida, airplane applications of malathion at 0.25 pound per acre as granules or in fuel oil has provided satisfactory kill of salt marsh mosquito larvae[A]. However, in earlier experiments granular formulations at levels of 0.5 pound per acre yielded mortalities from 64 to 99 percent. Similar application of granular parathion at 0.05 to 0.1 pound per acre yielded excellent control of these species[A,B]. Dipterex granules gave effective larval reduction at 0.75 pound per acre but failed at 0.5 pound per acre. Variations observed in control effectiveness at the same or higher dosages apparently arise from differences in the vegetative cover of area treated.

Organophosphorus toxicants also have been used to control *Aedes* breeding in irrigated pastures in Oregon and California and *Psorophora* infestations in the rice fields of Mississippi and Arkansas. Parathion when introduced in the irrigation influent at concentrations as low as 0.01 p.p.m. gave effective control of *A. nigromaculis* in pastures up to a distance of 0.25 mile. At a dosage of 0.1 p.p.m. of parathion, control extended to 0.37 mile. Phosdrin at 1.0 p.p.m. or Dipterex at 0.5 p.p.m. produced effective reduction of *Aedes* breeding in pastures up to 0.5 mile but at levels of 0.5 p.p.m. (Phosdrin) and 0.25 p.p.m. (Dipterex), both toxicants gave unsatisfactory control[A,C]. The efficacy of this method of controlling mosquito breeding in pastures is influenced by the terrain of the field and by other factors such as seepage so that consistent results are not always obtainable.

Seepage also markedly influences the results obtained by the addition of organophosphorus toxicants to irrigation water in rice fields. Solubilized parathion introduced at a rate of 0.02 p.p.m. into a 94-acre rice field in Mississippi flooded by contour terrace irrigation practices gave excellent control of *Psorophora* breeding in the terraces near the influent but had little effect upon infestations in the outlying terraces. The latter in many cases had been flooded by subsurface seepage water and this seepage together with the time required to inundate the field completely either removed or deactivated the toxicant. In Arkansas, in tests in fields which were flooded directly from the canals and not through successive terraces, parathion (0.02 to 0.05 p.p.m.), Phosdrin (0.25 p.p.m.) and Dipterex

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(0.5 p.p.m.) produced effective kill of *Psorophora* larvae. Under these conditions the treated water traveled as far as 1.3 miles in an irrigation canal without loss of effectiveness. However, where seepage occurs, the water in a terrace adjacent to one yielding 100 percent kill, may produce little or no mortality of *Psorophora* larvae.

Psorophora infestations were not reduced by granular preparations of DDVP and malathion spread at a rate of 0.75 pound of toxicant per acre on dry plots 1 day prior to flooding. In contrast postflood application of malathion at 0.2 lb. per acre gave excellent control of rice field mosquito larvae. While the latter treatment is feasible for pasture or ditch infestation, it is not practical for treatment of large rice fields where the progressive hatching of mosquitoes over several weeks would require repeated applications.

Residual larvicide treatments provide control for extended periods, thus differing from the methods previously discussed in which periodic retreatment is required. In the Savannah, Georgia, area, BHC (12 percent gamma) emulsions applied at the rate of 1 lb. of BHC per acre (in 2 gallons of finished spray per acre applied in the same manner as oil solutions) to small landlocked ponds have given satisfactory control of anopheline and culicine species for periods of 5 to 8 weeks. Despite 3 consecutive years of treatments of five applications per year, no fish kill occurred. In similar ponds DDT emulsions at an application rate of 3 pounds per acre and dieldrin at 1 pound per acre prevented mosquito production for 3 to 6 and 12 months, respectively. *However, DDT or dieldrin treatments of this type are totally destructive to fish and should not be used where such wildlife is present.*

Control of various species of *Aedes* and *Culex* in the western United States also has been accomplished by residual larviciding. Limited field experiments with dieldrin, DDT and heptachlor against culicine breeding (*C. tarsalis, C. stigmatostoma, C. pipiens,* and *Culiseta incidens*) in log ponds in Oregon indicated that dieldrin emulsion and heptachlor granules at 3 and 5 pounds of toxicant per acre, respectively, gave good control for 14 weeks. DDT, at a rate of 10 pounds per acre, was much less effective. In studies (1956) at Chinook, Montana, preflood or postflood treatments of plots (0.1 to 2.0 acres) in alfalfa fields, pastures, and ditches associated with irrigation, with dieldrin and heptachlor at rates of 1.0 and 1.5 pound of toxicant per acre were effective in preventing breeding of *Aedes dorsalis, A. vexans,* and *Culex tarsalis* for extended periods (up to 16 weeks). Dieldrin was employed as 10 percent granules or 0.5 percent emulsion, heptachlor as 5 percent granules and 0.75 percent emulsion. DDT as a preflood treatment at 3.0 pounds per acre (1.5 percent emulsion or 10 percent granules) was effective for 6 to 14 weeks. In Mississippi areas where *Psorophora* are susceptible to dieldrin, prevention of breeding has been accomplished by a single preflood application of dieldrin emulsion at a rate of 1 pound of toxicant per acre. Preflood application of the same dosage of dieldrin per acre in granular form or a postflood treatment with treated rice seeds (1.0 pound toxicant per acre) gave unsatisfactory results.

Another form of residual larviciding is found in the use of dieldrin-cement pellets for control of domestic species (i.e., *Aedes aegypti* and *Culex quinquefasciatus*). Incorporation of dieldrin water-wettable powder (50 percent) in sand: cement (1:5) and application at a rate of one 10-gram pellet (content 16.6 percent dieldrin) to two gallons of water has prevented mosquito infestation for as long as 1 year. This technique appears to have value for treatment of fire barrels and similar water storage sites.

Adulticides

Adult mosquito densities can be reduced effectively by exterior or interior space treatments or by residual applications. Outdoor space applications provide only temporary relief from mosquito annoyance and must be repeated in accordance with the rapidity with which an area becomes reinfested from areas outside the treated zone. Residual sprays are active against the mosquitoes for extended periods but may or may not affect the population on an areal basis.

For malaria control in the United States, the standard practice is to treat dwellings with 5 percent DDT emulsion at the rate of 200 mg. of toxicant per sq. ft. Since the principal vector *A. quadrimaculatus* has never shown any indication of developing resistance to DDT, other insecticides are not recommended for overall interior house treatment. However, in foreign areas where the anopheline vector is resistant to DDT deposits, dieldrin suspensions applied at a rate of 25 to 50 mg. of toxicant may be employed. In such areas water-wettable formulations are preferred because of transportation advantages and the greater effectiveness of such deposits, particularly with DDT. Laboratory tests against *A. quadrimaculatus* showed that suspension deposits at a dosage of 100 mg. of toxicant per square foot gave 90 percent kill of specimens exposed for 30 minutes for 13 weeks whereas the emulsion residues with a similar exposure period yielded 50 percent mortalities for only 4 weeks. Laboratory and field evaluation of commercially available pesticides as a residual application against *A. quadrimaculatus* indicates that of the organophosphorus toxicants malathion alone or in combination with DDT or dieldrin offers the most promise. In simulated field tests with animal baited huts initial experiments using malathion at 100 or 200 mg. of toxicant per square foot against dieldrin-resistant *A. quadrimaculatus* showed excellent kill of adult females for the entire 4-5 month observation period. Outdoor residual applications can be used as barrier strip treatments around individual premises to give relief from daytime annoyance by certain culicine species.

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DDT applied as a 1.25 percent emulsion at rates of 5 to 10 pounds per acre to the outside of houses and to shrubbery, grass, and other vegetation within a radius of approximately 100 feet of the dwelling caused significant reduction in daytime annoyance from salt marsh mosquitoes for periods of 1 to 9 weeks. Other pesticides — BHC (1.3 pound gamma isomer per acre), dieldrin (4 pounds per acre), lindane (0.5 pound per acre), Diazinon or malathion (2 pounds per acre)— were ineffective. Variations in the duration of effectiveness of the DDT treatments is attributed to mosquito potential, more frequent treatments being required whenever weather conditions permit excessive mosquito production. In 1952, 1954, and 1955, the application of 5 pounds of DDT per acre gave 5 and 6 weeks of relief from mosquito annoyance. In 1953, the same treatment was effective for 1 to 2 weeks.

In Montana, similar application of 5 percent DDT emulsion on farm premises resulted in a 75 to 98 percent reduction of a daytime biting rates of *A. vexans*, *A. nigromaculis* and *A. dorsalis* for at least 20 days. Because new populations of mosquitoes usually invade an area at dusk, these barrier strip treatments have little effect on nighttime biting rates.

Outdoor space treatments with mist or fog machines are utilized chiefly against culicine species. Susceptible strains of *Culex*, *Aedes*, and *Psorophora* can be controlled effectively by applications of fuel oil solutions of DDT (5 percent), chlordane (2.5 percent) or lindane (2 percent). The dosage rates of outdoor space treatments on an acre basis depends upon several factors including topography, vegetative cover, wind conditions, swath width, etc. In general, treatments which give 0.5 pound of DDT or 0.2 pound of chlordane or lindane per acre provide satisfactory reduction of mosquito densities. Because of the variables present, it is desirable for a supervisor to evaluate the performance qualities of the equipment with the formulations employed and from these data establish operating procedures under different weather conditions and terrain. The reduction of mosquito densities by space applications is temporary and where the mosquito populations are high, daily treatments may be necessary.

At a drive-in theatre at Savannah, Georgia, excellent nighttime control of susceptible adult salt marsh mosquitoes has been obtained by single fog applications of 1 gallon of 2.5 percent DDT, 1.0 percent chlordane, or a pyrethrum formulation containing 0.25 percent pyrethrins and 2.0 percent piperonyl butoxide in a 1:1 fuel oil - kerosene solution. Application of the fog at or after dusk was essential to effective abatement, since treatment of the area before the major infiltration of the mosquitoes occurred gave poor results. In areas where the species are resistant to DDT, related chlorinated hydrocarbon insecticides (lindane, chlordane) can be substituted effectively.

When mosquitoes no longer respond to treatments with chlorinated hydrocarbon toxicants, organophosphorus compounds become the insecticide of choice. Malathion is highly effective against most resistant species. Fuel oil solutions of malathion dispersed by airplane (3-4 quarts per acre) gave excellent reduction of salt marsh mosquito densities in citrus groves and open marshes 6 hours after treatment at dosage rates of 0.05 to 0.5 pound per acre[A]. In wooded areas or mangrove marsh, treatments at 0.1 to 0.25 pound per acre gave poor results. Against *A. nigromaculis*, aerosol treatment with 5 percent malathion in diesel oil at a rate of 12 gallons per linear mile produced 95 to 100 percent reduction in landing rates for a distance of 100 yards from the machine. Field experiments[A] with formulations of Dipterex or Diazinon against salt marsh mosquitoes indicate Diazinon at .05 and 0.1 pound per acre to give effective kills but Dipterex at 0.1 - 0.25 pound per acre did not produce satisfactory reductions. At 0.5 pound per acre, Dipterex gave adequate control in one of two field trials.

In addition to outdoor mist and fog treatments, application of insecticidal dusts appears to have promise in the reduction of adult mosquito densities. In Montana the dispersal of 3 percent gamma BHC dust at 30 to 35 pounds per linear mile effectively reduced nighttime densities of susceptible *A. vexans*, *A. dorsalis* and *A. nigromaculis* in an urban area on the evening of treatment. In Savannah, Georgia, preliminary tests against caged adult salt marsh mosquitoes indicated that slightly higher kills were obtained with malathion dust formulations than with mist sprays. The dosage range for effective reduction at distances up to 600 feet was 0.2 to 0.4 pound per acre.

FLY CONTROL

After several years of intensive usage of organophosphorus compounds, evidence is increasing that *Musca domestica* may develop widespread resistance to malathion and/or Diazinon in this country as has been reported from Denmark and Italy. Recent findings indicate that malathion-resistant strains exist in Arizona, Florida, and Georgia. The dairies or chicken ranches at which resistant strains were recovered have been subjected to repeated treatments with baits and/or sprays containing organophosphorus toxicants for several years. A strain recovered at an Arizona dairy with a history of treatment with malathion (1954-56) and Diazinon (1956-57) has been shown by topical applications to be physiologically resistant to malathion, Diazinon, and parathion. One hour exposure of female flies to residues of either malathion (200 mg. plus 500 mg. of sugar per square foot) or Diazinon (100 mg. plus 250 mg. of sugar per square foot) produced 24-hour mortalities of only 1 percent. In addition to being physiologically resistant to malathion, strains from 2 chicken ranches near Savannah, Georgia, showed behavioristic resistance to the compound (i.e., the flies appeared

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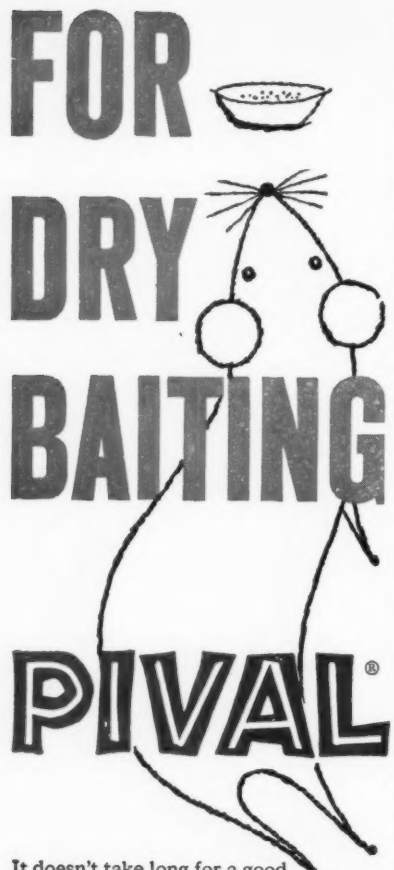

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to avoid rather than frequent malathion baits). Preliminary studies of resistant females topically treated with malathion indicate that they degrade malathion rapidly to an unidentified metabolite.

The previous findings again emphasize the ability of *M. domestica* to survive despite chemical measures which initially appear to threaten its existence. They also stress the need for major reliance upon sanitational means, the use of several control procedures, and continued efforts towards the detection of resistance on community programs.

Residual Treatments

In areas where house flies are susceptible to DDT, this chemical is still the insecticide of choice, except in dairy barns or other situations where it may contaminate milk or food. Finished emulsions or suspensions of 5 percent DDT will provide effective residues when applied to the point of run-off.

Where DDT-resistant house fly populations develop, other chlorinated hydrocarbon insecticides can be utilized as initial substitutes. In time, the flies may develop resistance to one or all of the substitute chemicals in this group, but the onset and rate of development of resistance is contingent upon the locality and the history of insecticidal treatment. Dieldrin (0.625 or 1.25 percent emulsion), chlordane (2.5 to 5 percent emulsion) or lindane (0.5 to 1.0 percent) has provided effective control of DDT-resistant strains when applied to the point of run-off on exterior surfaces of houses (including porches) and animal shelters. Applications of these latter insecticides within homes should be limited to treatments of selected surfaces such as doors, window sills, and screens. Neither dieldrin nor chlordane is approved for use in dairy barns, but lindane (or methoxychlor at 200 mg./sq. ft.) is acceptable for that purpose.

Residual treatment of privies including the pit contents with dieldrin, BHC and chlordane should be avoided, since such applications markedly increase house

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fly production therein. Furthermore, untreated privies generally are poor sources of house fly breeding.

Inasmuch as house fly populations throughout the United States exhibit general resistance to chlorinated hydrocarbon insecticides, organophosphorus compounds are the current insecticides of choice. Three pesticides, malathion, Diazinon, and Korlan (Dow ET-14), have been approved for use in dairy barns as formulations containing approximately 1 percent of the toxicant.

Laboratory and field tests indicate that a sugar additive generally augments the effectiveness of residues from emulsion formulations of malathion, Diazinon, and other candidate organophosphorus insecticides. The relative value of this additive varies with the toxicant; certain experimental compounds show little residual activity when used alone. In addition, the concentration of the toxicant appears to be a factor. Diazinon at a rate of 100 mg./sq. ft. gave similar results with or without a sugar additive. At a rate of 20 mg. of Diazinon per square foot, the inclusion of sugar definitely improved the residual effectiveness of the treatment. As a general rule, the sugar is added to the formulation at a rate of 2.5 parts of sugar to 1 part of toxicant.

Reports on the period of effectiveness of malathion and Diazinon treatments indicate variable results. In the Savannah, Georgia, area, malathion:sugar formulations (200:500 mg./sq. ft.) gave good control up to 7 weeks while Diazinon:sugar applications (100:250 mg./sq.ft.) yielded similar or higher levels of effectiveness. However, the results, particularly with malathion, were erratic, three dairies showing satisfactory control for 6 to 7 weeks, one for 3 weeks and the fifth for 1 week. In other areas, experimental data for these two compounds reflect control for longer or shorter periods than indicated above, presumably an effect of differences in the fly potential or climatic factors involved.

Korlan which recently was approved for use in dairy barns has given excellent control of house flies for periods of 8 to 9 weeks in the Savannah, Georgia, area when applied at a rate of 200 mg. per square foot to the interior surfaces of dairies. At 100 mg. per square foot with or without a sugar additive, the period of effectiveness of Korlan was 4 to 5 weeks. The toxicologic hazard of this compound is similar to that of malathion.

Residual treatments are effective against other flies that have resting habits similar to those of the house fly. The lesser house fly, *Fannia canicularis*, which frequently is a pest in chicken ranches and dairies, is readily susceptible to residual applications of dieldrin and malathion. Dieldrin at a dosage of 25 mg. per square foot remains effective for extended periods whereas the toxicity of malathion deposits is relatively short lived. However, the latter compound will control both *Fannia* and resistant *M. domestica*.

Impregnated Cords

The installation of parathion or Diazinon impregnated cotton cords in animal shelters has provided season long control of *M. domestica* in the Savannah, Georgia, area. A single treatment with cotton cords (3/32″ diameter) dipped in 5 or 10 percent parathion-xylene solution or with similar cords (3/16″ diameter) immersed in 25 percent Diazinon-xylene solution reduced fly densities to satisfactory levels for 5 to 6 months in dairy barns. On 25 rural premises, the installation of treated cords in barns, pig pens, chicken sheds, kitchens, and porches produced satisfactory to excellent fly control for 8 to 17 weeks. Similar periods of effectiveness resulted in tests conducted on chicken ranches. Parathion treated cords (3/32″ diameter) were effective in military dining halls and kitchens for 10 weeks as compared to 7 weeks effectiveness for similar size cords impregnated with Diazinon.

The installation rates for treated cords are 30 linear feet per 100 square feet of floor area. Data indicate that a cord (3/16″ diameter) is essential for season long control with Diazinon, the smaller cord (3/32″ diameter) yielding only 7 weeks abatement in dairy barns.

Recent studies in Utah with cotton cords (3/32″ diameter) impregnated with a 10 percent parathion:2.5 percent Diazinon-xylene solution indicate that this treatment is effective against *Fannia canicularis* populations in dairies. Five of six dairies treated showed satisfactory control for the July through September period. The average count of *Fannia* per 500 square feet of floor area for the six dairies ranged from 1 to 25 during the 12-week test period as compared to the indices of 49 to 1,100 for three untreated barns.

Because of the extreme toxicity of parathion, preparation of treated cord should be handled only by experienced formulators. Both the public and pest control operators should use only commercially prepared cords which are approved for use in dairy barns, chicken ranches, and food producing establishments. Periodic checks of the cholinesterase levels of all personnel routinely preparing or handling treated cords are desirable. Individuals installing treated cords continually should wear cotton gloves. As a maximum safeguard, impregnated cords should be colored or marked to avoid their possible use for purposes other than fly control. Details on the precautionary procedures for parathion are found in the Clinical and Operational Memoranda issued by the Communicable Disease Center. Although Diazinon has a lower toxicity level to humans than parathion, procedures similar to those outlined for that pesticide should be followed in the preparation and marking of Diazinon-treated cords.

Poison Baits

Poison baits continue to receive widespread popular acceptance as a means of accomplishing fly control. The basic formulation of liquid and dry baits consists of

an organophosphorus toxicant and a fly attractant (molasses, sugar, or other sweetening agent). The latter may be replaced in part by inert diluents of various types. Pesticides commonly employed in baits and accepted for use in dairy barns are malathion, Dipterex, Diazinon, and DDVP, the latter alone or combined with malathion or Diazinon. None of these baits should be employed inside homes.

Dry baits are formulated to contain 1 to 2 percent toxicant and an attractant. The latter may be granulated sugar or an inert carrier coated or mixed with an attractant. Such baits are scattered over the floor surface at a rate of 2 to 4 ounces per 1000 square feet. Where debris is present, the bait should be placed in a container or on a sheet of wood, metal, or other relatively smooth material.

General coverage of the floor area with either type of bait is not desirable. Observation will show the sites of greatest fly concentration, and bait applications should be made at these points. Occasionally it may be necessary to utilize sites other than those at the floor level (window sills, stanchions).

Liquid baits generally are composed of 0.1 to 0.2 percent toxicant and 10 percent attractant. Application is usually by means of a sprinkling can, and the bait is distributed at a rate of 1 to 3 gallons per 1000 square feet of floor area. If the floor surface is dirt, or is covered with debris, the bait should be sprinkled on paper or on metal or wooden sheets.

The frequency of bait application depends largely upon the fly potential present. Where the potential is high, repeated applications are necessary. In studies at Savannah, Georgia, the use of permanent bait stations has resulted in good house fly control in two dairies with a minimum number of applications. These stations were plywood trays (18" square) charged with a dry 2 percent malathion bait, placed at the rate of 4 oz. of bait per 1000 square feet. Approximately 8 to 12 stations were established at sites characterized by high fly populations. In the milking room baits also were scattered on boards, above the stanchions or on the floor and in one barn additional plywood trays (1/4′ x 1′) were utilized. Results indicated that after 4 treatments for the first two weeks satisfactory control was achieved for 12 weeks at one dairy with weekly applications of 1.5 pounds of bait. At the second dairy which received weekly treatments of 2.5 pounds of bait, control persisted till the end of the season (15 weeks). The loss of control at the first dairy arose from the development in the fly population of a behavioristic resistance to the malathion bait. Adequate control was not re-established regardless of the frequency of bait renewal or the use of other types of malathion baits. However, the fly population did frequent baits containing organophosphorus toxicants other than malathion.

The principal values of poison baits lie in their relatively low cost per treatment and in their immediate suppressive effect upon fly densities. Bait treatments generally produce spectacular reduction of high fly densities within a few hours. However, this effectiveness is of short duration unless further applications are made. Consequently, the success of bait applications in controlling fly populations is dependent on the diligence of the operator. Field substantiation of this point was shown by comparison of fly densities in four dairy barns in which the owners used poison baits. Over a 3-month period the results showed fluctuating levels of fly reduction; only one dairyman achieved satisfactory control.

In laboratory studies[A], synergized pyrethrin or allethrin dry sugar baits were shown to have promise in reducing densities of malathion-resistant house flies. Combinations of pyrethrum or allethrin and piperonyl butoxide at a ratio of 1:10 when tested at concentrations of 0.01 to 1.0 percent toxicant against malathion-resistant and susceptible strains indicated only minor differences in the level of kill of the two strains. Field tests of similar baits against house flies in dairies showed the pyrethrin formulations to give satisfactory kills which were superior to those achieved with the allethrin formulations.

Poison baits also are of value in the control of blow flies and house flies frequenting garbage dump areas. A bait consisting of 2 percent toxicant and 50 percent molasses has given good control of these insects when applied to dumps at a rate of 1 gallon per 1000 square feet of area.

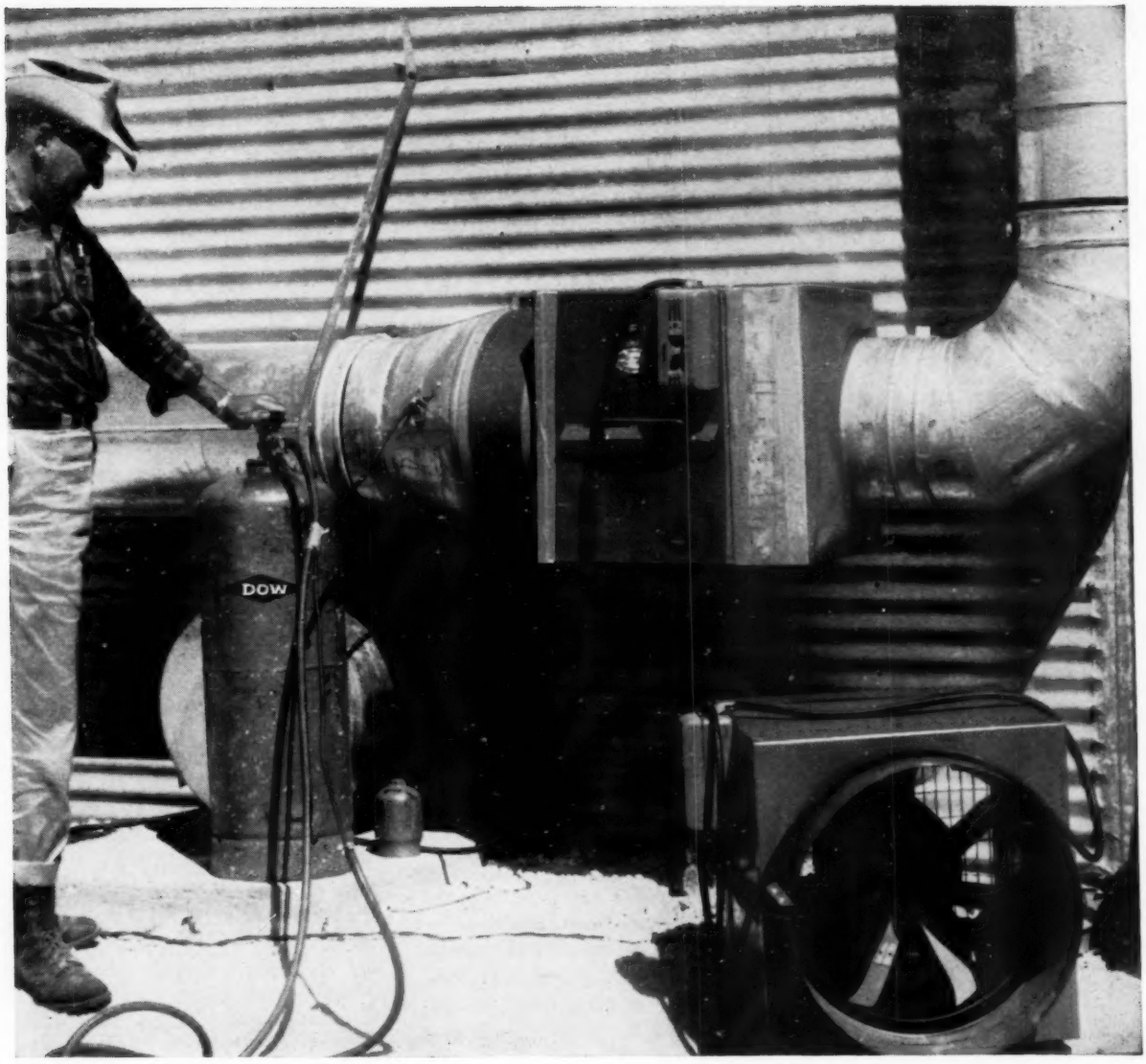
Outdoor Space Sprays

Where house flies do not respond to control by residual or larvicidal treatments space sprays represent the method of choice for chemical control on a community basis. The method also can be utilized for fly control at abattoirs, dumps, and other problem sites. In a locality of high fly potential, the effectiveness of a space spray treatment is temporary and re-applications must be made, sometimes on a daily basis, to insure continued control. Since the efficacy of a space spray treatment depends on the insect coming in contact with the insecticidal droplets, applications must coincide with the daily pattern of fly activity.

Flies which are susceptible to the chlorinated hydrocarbon insecticides can be killed with emulsions of fuel oil solutions of DDT (5.0 percent), chlordane (2.5 percent) or lindane (2 percent). If odor is not a factor, a 5 percent technical BHC emulsion (12 percent gamma isomer) is cheaper than lindane and equally effective. The rate of application per acre for these pesticides should be approximately 0.4 pound for DDT and 0.2 pound for the other pesticides.

Against DDT-resistant flies, chlordane and lindane are effective. The addition of DMC to DDT formulations also will control DDT-resistant flies. Under field conditions a formulation of DDT:DMC at a ratio of 7.5:1 gave excellent reduction of house flies resistant to several chlorinated hydrocarbons.

Pyrethrum space spray is the



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least toxic to man and is among the most reliable as an insecticide. For indoor space spray treatments, it is the insecticide of choice. Pyrethrum formulations are used in combination with synergists (piperonyl butoxide, sulfoxide, and other) in emulsions or oil solutions containing from 0.05 to 0.1 percent pyrethrins and from 0.5 to 1.0 percent of the synergist. While pyrethrum formulations usually are uneconomical for general large-scale application in fly control, their use at problem sites frequently is feasible.

Limited tests indicate that malathion in fuel oil will provide effective kills of resistant adult house flies when applied by a mist blower as a 5 percent solution at a rate of 0.5 pound of malathion per acre.

Larvicides

Larvicides are of value in fly control for the treatment of garbage or of animal excrement as it accumulates at stockyards, chicken farms, or other problem sites. Since the use of larvicides may cause or augment the rapid development of resistance in the fly population, sanitational practices should be regarded as the first line of defense, larvicidal applications being utilized only as an emergency or occasional measure.

In the absence of resistance to chlordane, lindane, BHC, or dieldrin in the house fly populations, such chemicals serve as effective larvicides. Application should be at the same dosage per square foot as recommended for residual treatments. Aldrin is also an effective larvicide and should be applied at a rate of 25 to 50 milligrams per square foot.

In laboratory studies of EPN, Diazinon, malathion, parathion, Dipterex, and several experimental organophosphorus compounds against house fly larvae, Diazinon was found to be the most potent insecticide. Field tests substantiate the effectiveness of Diazinon as a larvicide in chicken excrement. Suggested application rates are 50 to 100 mg. of Diazinon per square foot although in some studies a dosage of 25 mg. per square foot has given satisfactory kills. The control achieved with Diazinon treatments is temporary; reinfestation usually occurs within 10 to 14 days. The formulation is applied at a rate of 7 to 14 gallons per 1,000 square feet.

In 1957, tests at Savannah, Georgia, compared the effectiveness of paradichlorobenzene (PDB), Thiourea, and Diazinon as fly larvicides in chicken excrement. Results based on total house fly emergence in screened chicken batteries indicated that Diazinon at 100 mg. per square foot was superior to Thiourea (300 and 500 mg./sq. ft.), PDB (2000 mg./sq. ft.), and Diazinon (50 mg./sq. ft.). The treatments of Diazinon and Thiourea were applied at a rate of 10 gallons per 1000 square feet; PDB was mixed with sawdust and broadcast at the dosage rate specified.

The application of 2 oz. of PDB crystals per garbage can has been shown to give satisfactory control of fly breeding therein for 1- to 2-week periods.

As blow flies continue to remain susceptible to chlorinated hydrocarbons, these chemicals are effective in preventing blow fly infestations of carcasses and in controlling established blow fly infestations in carcasses. Limited studies have shown that dog carcasses sprayed with 1 pint of 0.25 percent aldrin, endrin, or diazinon emulsion were protected from blow fly infestation for 26 to 30 days. Chlordane (0.5 percent), BHC (1.0 percent (15 percent gamma)), and malathion (0.25 percent) were less effective. In carcasses heavily infested with larvae, 0.25 percent emulsions of endrin, Diazinon, and malathion, and 0.5 percent emulsions of dieldrin and aldrin gave complete kill of full grown maggots. Concentrations of 2.0 percent chlordane and 5 percent BHC were required for effective reduction of the infestations.

In general, the chief difficulty in obtaining satisfactory larval control is the inadequate penetration of the medium by the toxicant. An application rate of 5

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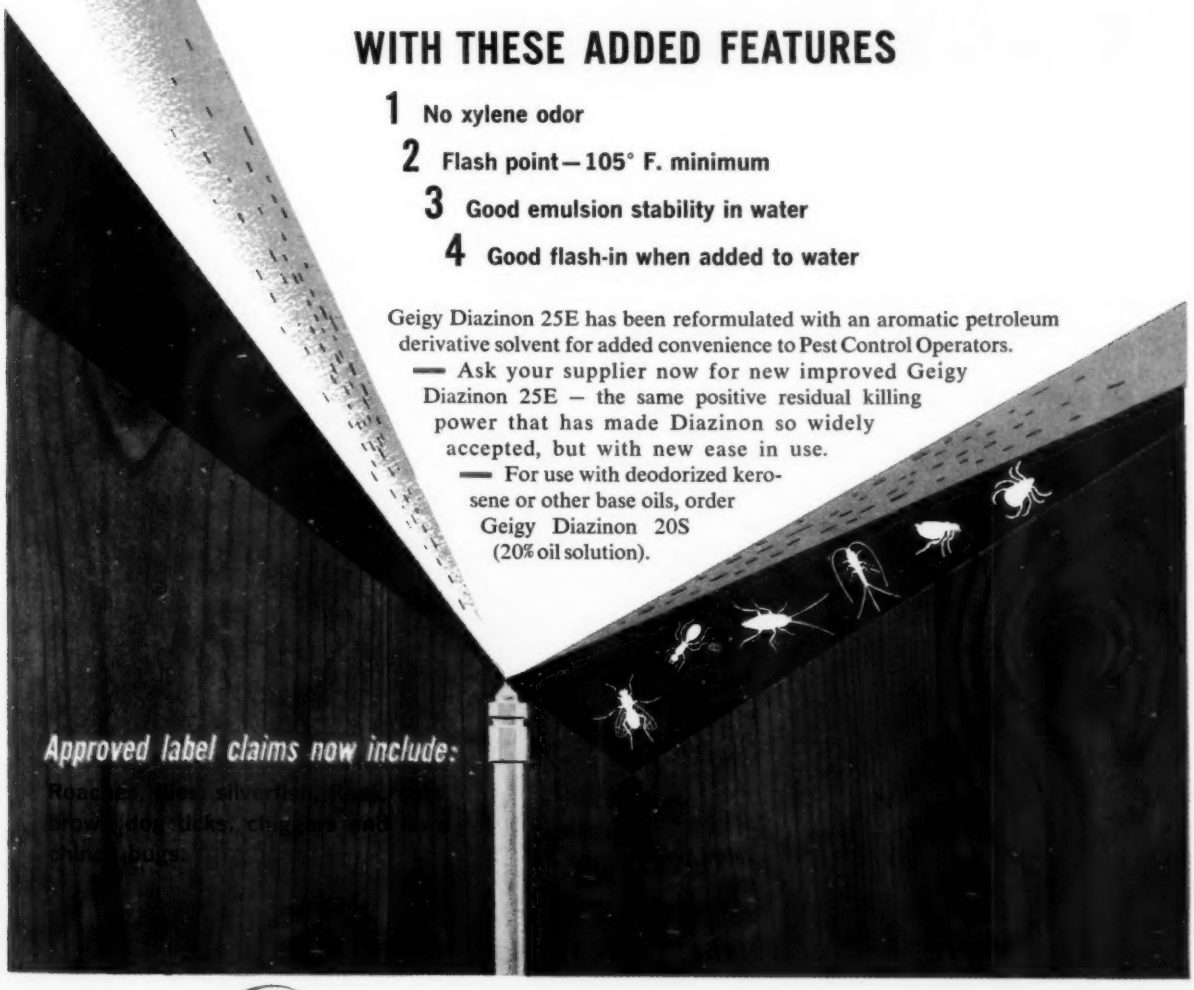

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gallons of 0.5 percent formulation per 1000 square feet will give far better penetration of chicken excreta than 1 gallon of a 2.5 percent emulsion, even though both sprays provide the same dosage of toxicant. Consequently, the formulations used for larviciding should be made at 4 to 6 or more times the volume commonly employed for the insecticide when applied as a residual treatment. Since the pesticides used as larvicides also are toxic to the adult flies, spray applications should include surfaces which the adults contact upon emergence.

FLEA CONTROL

The oriental rat flea, *Xenopsylla cheopis* is readily controlled by the application of a 5 or 10 percent DDT dust to rat runs and harborage areas. While the 5 percent dust is equal to the 10 percent formulation in its effectiveness on *X. cheopis*, the greater toxicity of the 10 percent dust to other ectoparasites normally less susceptible to DDT, such as the cat flea, makes it the formulation of choice.

Reports continue to occur of the difficulty in controlling yard infestations of dog and cat fleas *Ctenocephalides canis* and *C. felis* with repeated applications of DDT or chlordane. Nonetheless, attempts to demonstrate such resistance in the laboratory have been unsuccessful. In recent studies[A] parallel exposure of a strain of fleas collected at a residence where three successive treatments of 1 percent chlordane had failed and of a laboratory strain to deposits of DDT and chlordane again showed both strains to be equally susceptible to these toxicants.

Premises treatment[A] with 1.0 percent emulsions of chlordane, Diazinon, malathion, lindane, and Dipterex indicated that Diazinon was the most effective, giving 100 percent reduction for the 63-day observation period. Lindane approached Diazinon in effectiveness while malathion and Dipterex yielded satisfactory mortalities for 7 and 35 days, respectively. Chlordane was ineffective at 1.0 percent but application of a 5 percent emulsion gave 84 percent or greater reduction for 63 days. A single test using 0.5 percent Diazinon yielded results similar to those achieved with the 1.0 percent formulation.

For flea control on dogs and cats, malathion as a 5.0 percent dust or as a 0.5 percent spray is acceptable. This toxicant also is suitable as an animal dip at 0.25 percent but the treatment should be done under the supervision of a veterinarian.

Other toxicants suitable as dust treatments for either dogs or cats are rotenone or pyrethrum at 1 percent and synergized pyrethrum (0.2 percent). Lindane (1 percent) and chlordane (2 to 4 percent) dusts should be applied only to dogs.

Satisfactory flea control on premises is dependent largely on the adequacy of coverage. Treatment of the animal and its quarters alone frequently may not eliminate an infestation because the insect also is breeding at other sites on the premises. When these breeding sites remain untreated, the result is poor control, a condition which may be ascribed erroneously to resistance rather than to inefficient operations.

ROACH CONTROL

Chlordane resistance in German roach populations occurs in many parts of the United States, particularly the southeastern area. The organophosphorus compounds are the most effective toxicants for use against resistant roaches, but none of the materials apparently produces the level of control formerly achieved with chlordane. Malathion (1 to 5 percent sprays or dusts), Diazinon (0.5 percent spray), malathion: perthane combined 1:2 (4 percent spray), or Dipterex (1.0 percent spray) is suitable for use against resistant strains. However, household usage of Dipterex is restricted to pest control operators only. Application of any of these pesticides should be as a spot treatment, utilizing a coarse spray to treat baseboards, along water pipes, and other roach harborage areas and runways. In studies[A] of household treatments

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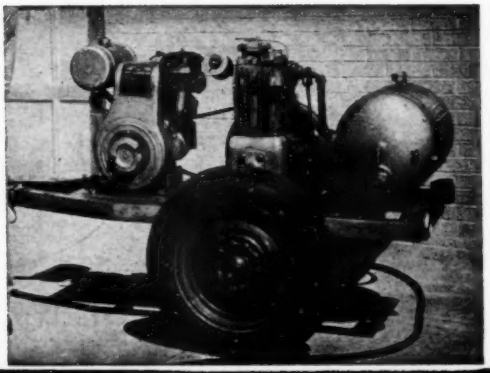

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with oil sprays of Diazinon (0.5 percent), malathion (2 percent), Dipterex (2 percent), chlordane (2 percent), and a dust of sodium fluoride, results indicated Diazinon and malathion to be the most effective. During the 7-week observation period, the percent reduction averaged 94 to 99. Chlordane gave maximum reduction of nonresistant roach infestations, but against resistant strains only showed a percent reduction ranging from 52 to 93. Sodium fluoride gave 42 to 62 percent reduction for a 3-week period.

Against susceptible *Blattella germanica* and for the control of other species of roaches, chlordane up to 3 percent as an emulsion or solution and dieldrin as a 0.5 percent solution or 1.0 percent dust are the insecticides of choice. To attain a quick kill in heavy roach infestation, aerosol formulations of pyrethrum alone or in combination with a chlorinated hydrocarbon insecticide are of value. Pyrethrum dusts (1.0 percent pyrethrins) are useful against both resistant and susceptible roaches.

BED BUG CONTROL

As bed bug resistance to DDT is not widespread, this pesticide continues to be the insecticide of choice for the control of *Cimex* spp. An application of 5 percent DDT emulsion or solution to the baseboards, wall crevices, bedsteads, and mattresses of infested rooms usually gives excellent control of these insects.

Where DDT-resistant bed bugs are encountered, lindane (0.1 percent) or malathion (0.5-1.0 percent) can be utilized. With either insecticide, the treatment of mattresses and upholstery must be done with care so that only a light application of the toxicant is obtained. Under no circumstances should these materials be soaked with spray. As an added precaution, the bedding used by infants should not be treated. Retreatment of mattresses and furniture should not be made at less than 2-week intervals.

TICK AND CHIGGER CONTROL

Area control of ticks can be obtained with applications of any one of several chlorinated hydrocarbon insecticides. DDT, chlordane, dieldrin, and toxaphene at rates of 1.0 to 2.0 pounds of toxicant per acre or BHC at a rate of 0.5 pound of the gamma isomer per acre give effective abatement of ticks under field conditions. Sprays (suspensions or emulsions) or dust formulations of these pesticides produce similar results. The level of control secured is dependent on the adequacy of the coverage. In brushy areas 50 gallons of spray or 40 pounds of dust per acre are required as compared to approximately half those amounts in sites of thin cover such as lawns, etc. Treatments with these chemicals usually prevent reinfestation for 30 days or more.

Ticks, principally the brown dog tick *Rhipicephalus sanguineus*, occasionally invade dwellings and cause severe annoyance problems to the occupants. Formulations containing 3 percent chlordane, 5 percent DDT, 0.5 percent dieldrin, 0.5 percent lindane or 0.5 percent Diazinon are effective against this species. These pesticides should be employed as *spot treatments* to baseboards, floor and wall cracks, and other harborage sites within the house as well as to the sleeping area of the dog. In areas where the control of this tick by DDT and chlordane sprays has not been satisfactory, lindane applications have given good results. Diazinon, recently approved for household application, also is of value against resistant strains of the tick. Neither Diazinon nor dieldrin formulations should be used on animals, dusts containing lindane (1 percent), chlordane (2-3 percent), or DDT (5 percent) being suitable for that purpose.

For controlling area infestations of chiggers, the locality should be treated with toxaphene or chlordane at 1 to 2.0 pounds per acre, lindane at 0.25 to 0.5 pound per acre, or dieldrin at 0.5 to 1.0 pound per acre. Either spray or dust formulations can be employed, special care being taken to insure thorough coverage of the area. Application rates of 40 pounds of dust or 50 gallons of spray per acre may be required.

In treating woodland areas for tick or chigger control avoid application of dieldrin or toxaphene to ponds, streams, and other water courses or to their adjacent margins since these pesticides are highly toxic to fish.

RODENT CONTROL

The importance of sanitation, including proper garbage disposal, food storage, harborage elimination, and ratproofing, must be emphasized. Sanitation is essential to the permanent control of commensal rats and mice, and the use of rodenticides should be regarded as supplementary to sanitation.

The situation with regard to rodent control is quite encouraging, since rats, unlike insects, do not appear to have developed resistance to the available poisons. The slow-acting rodenticides, including warfarin, pival, coumachlor, fumarin, and Diphacinone are preferred for use in most situations because of their effectiveness and low degree of toxic hazard to humans and useful animals. Of this group, warfarin has had the widest use in this country.

Warfarin

It has been shown that the susceptibility to warfarin of the various species of commensal rodents differs. Accordingly, in the interest of economy and safety, the lowest bait concentration consistent with the most effective control should be used.

Dependable control of the roof rat *Rattus rattus* requires the use of a concentration of 0.250 mg. of warfarin per gram of bait (0.025 percent). However, field tests have shown that a concentration of 0.050 mg. per gram (0.005 percent) is effective for control of the Norway rat (*R. norvegicus*). Mice react in the same general way as Norway rats, although they show more individual variation. There is evidence that under certain conditions Norway rats may be controlled a little more rapidly, though no more surely, by using 0.100 mg. of warfarin per gram of bait instead of 0.050 mg. per gram. However, where the species of rat con-

cerned is not definitely known or where roof rats are involved, the 0.25-mg.-per-gram concentration should be used. Commercial concentrates generally contain 0.5 percent warfarin in corn starch. To obtain the 0.25 mg.-per-gram concentration (0.025 percent), 1 pound of concentrate is diluted with 19 pounds of bait.

Warfarin baits may be used for initial rodent control under essentially all conditions, using a minimum baiting period of 2 weeks. Consideration should be given to establishing permanent bait stations for control of rats in places which are subject to reinfestation. Two years of experience at Savannah, Georgia, have shown that Norway rats can be controlled in non-ratproof buildings so long as poisoned bait is available, but eradication was not achieved. No difference in the residual effectiveness of the 0.100- and the 0.050-mg.-per-gram bait concentrations was observed. The bait stations were inspected approximately every 6 weeks and fresh poisoned bait was supplied.

Pival

Pival (2-pivalyl-1,3-indandione) appears, in a general way, to be approximately equal to warfarin in rodenticidal effectiveness. In both laboratory and simulated field tests, the acceptance of pival baits by roof rats, Norway rats, and mice has been good. Laboratory tests showed that pival and warfarin were about equally good for mouse control. Against roof rats, pival was shown to be slightly better than warfarin in the laboratory and about the same under simulated field conditions. Both laboratory and simulated field studies indicated that pival in solid bait was somewhat inferior to warfarin for control of the Norway rat, but that pival-poisoned water (0.006 percent acid equivalent) with 5 percent sugar as an attractant was slightly more effective against this species than a comparable formulation of warfarin (0.005 percent acid equivalent). Pival concentrations in solid baits should not be less than 0.025 percent.

Corn meal, as well as some of the other ground grains, has proved to be a good bait material for use with rodenticides which require repeated acceptance over several days. However, in many areas the meal becomes insect-infested after several days of exposure and must be replaced at frequent intervals with fresh bait in order to assure continued acceptance by rodents. Pival has been found to inhibit the development of a number of insects that infest grain, including flour beetles (*Tribolium* sp.), cigarette beetles (*Lasioderma serricorne* (F.)), saw-toothed grain beetles (*Oryzaephilus surinamensis* (L.)) and flour moths (*Ephestia* sp.). Cockroaches, however, were not affected when fed for 30 days on bait containing 0.25 mg. of pival per gram of bait.

ANTU

ANTU still holds a definite place as a quick-acting poison for the Norway rat. Its use to reduce large populations rapidly may be followed by the use of anticoagulant rodenticides to achieve com-

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plete and lasting control. ANTU should not be used against the same populations more often than about once a year. It induces a persistent bait shyness in rats, and this property makes ANTU ineffective for repeated use against the same rat population. ANTU is not effective for the control of roof rats or mice. Its safety record is good and it may be used in residences and food-handling establishments. The concentration generally employed in solid baits is 2 or 3 percent.

Sodium Monofluoroacetate (1080)

Sodium monofluoroacetate (1080) is still the most effective, fast-acting rodenticide, but its extreme toxicity to man and animals requires that it be used only on certain types of premises and only by carefully trained crews. The precautions necessary for the safe use of 1080 are numerous and involved. They are described in the "Operational Memoranda on Economic Poisons" issued by the Communicable Disease Center.

Baiting Problems

In tests in Savannah, Georgia, corn meal has proved to be the most readily accepted cheap bait. In general, any available cereal may be used as bait material. It is worthwhile to restate that under certain conditions it is very difficult to get rodents to take any bait, e.g., where food is available in great variety and abundance, as in some warehouses. Such conditions constitute baiting problems, a term which implies that the origin of the difficulty lies not in the particular poison used but in the ecology of the rodents themselves. Obviously, in testing any given rodenticide formulation, it is necessary to be certain that apparent failure of the formulation is not caused by baiting problems. These problems can be solved effectively only through extensive knowledge of the habits of the rodents. Such problems do not occur more frequently when simple cereal baits such as corn meal are used than when complex bait mixtures are used.

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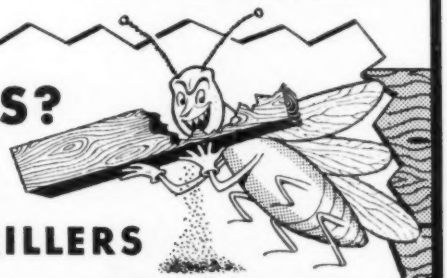

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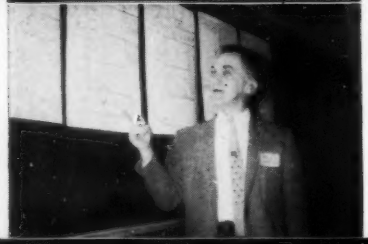
Wood-Destroying Organisms Theme Pulls Over 400 to Purdue Conference



Termite speakers at this year's Purdue Conference included (**top picture**) Purdue's Dr. John V. Osmun, left, and instructor William Butts; (**second picture**) Dr. H. O. Deay of Purdue, left, shown with PCO Harry Katz; (**third picture**) the NPCA's Dr. Ralph E. Heal; (**fourth picture**) Roy Pence of UCLA, center, shown with delegate Henry R. Isherwood, right; (**fifth picture**) Robert M. Russell; and (**bottom picture**) Myron W. Smith.

A full curriculum covering virtually all aspects of termite control helped draw over 400 industry members to Lafayette, Ind., Jan. 27-31 for the 22nd Annual Purdue University Pest Control Operators Conference.

"Termites and Other Wood Destroying Organisms," were the "Pest of the Year" and received major emphasis by Purdue University staff members and guest speakers from industry, suppliers, and other educational institutions. Also included in the five-day meet were lectures and demonstrations on cockroach control, flies, spiders, birds, new chemicals, equipment, and business communications.

One of the most significant observations coming out of the six rotating termite sessions held one day was the realization soil poisoning has become the predominant control method which structural alteration once was. PCOs were reminded the three principal control techniques spelled out in the 1951 National Pest Control Association's Approved Reference Procedures for Subterranean termite control are still essential to achieve maximum elimination of wood gnawers: **(1)** moisture control, **(2)** correction of structural faults, and **(3)** soil poisoning.

Moisture Dampens Effect Of Termite Treatment

Expanding the first of these three points, Dr. Ralph E. Heal, Executive Secretary of the National Pest Control Association, emphasized the importance of proper drainage. All downspouts should have elbows, he said, to get roof water away from the house and foundation. Otherwise, the moisture might enter the basement and create conditions conducive to termite attack.

Excessive use of water-based formulations in areas where the solution would remain puddled for an extended time might result in the development of mold and fungus on nearby wood. This, of course, is to be avoided to eliminate growth of these equally destructive wood-weakening organisms, Dr. Heal said.

Dr. Heal asked PCOs how they would treat a house where termites, in a grade stake left under the slab, were penetrating the slab and entering a door jam. Most operators agreed the TO would have to remove the door casing, drill under the floor, tear out what he could, and spray the drilled portion heavily. Dr. Heal pointed up the importance of sanitation in termite work, and the need for removing any wooden stakes or other cellulose debris from under homes.

To treat termite-infested houses, the TO must have a complete understanding of basic construction and its inter-relation to termite damage. This was the advice given by speaker Robert M. Russell, Technical Director of the Orkin Exterminating Co., Atlanta, Ga.

To illustrate the differences in the cost of various types of wood, he classified building timber into three main categories: resistant (which includes hardwoods and red cedars), pressure-treated, and yellow pine.

For a three bedroom, one-floor, 1,200-square-foot house, the lumber cost for resistant wood would amount to $1,980 compared with $924 for pressure-treated wood and $594 for the more termite susceptible yellow pine. According to Russell's figures, this means there is a difference of $330 between the cost of pressure-treated timber and yellow pine, and $1,386 between the cost of resistant wood and yellow pine.

Capillarity of 5 Soil Types

Although drainage on an infested property may appear satisfactory, it is necessary for the operator to familiarize himself with the ground water table in the area of the home he is treating. Russell cited the following figures, taken from Federal Housing Administration tests, to determine the normal comparable water rise through capillarity in

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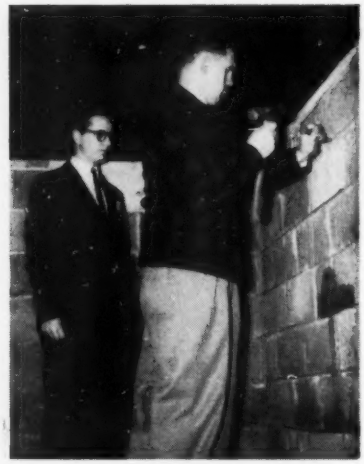

Termite chemical dispersion in concrete blocks was demonstrated by Purdue Instructor William Butts, left, in a conference experiment with a simulated block foundation wall. He is shown above with C. E. McCoy of Purdue, who is removing blocks to check penetration of the chemical. Test results indicated chemical penetrates deeper toward footing when injected in drilled mortar joints rather than in each void of the block.

the five following types of soil:

Soil	Rise
Clay	11.5′
Silt	11.5′
Fine Sand	7.5′
Coarse Sand	2.6′
Gravel	00

In the pre-treating phase of termite control, Myron Smith of Hill-Smith Systems, Memphis, Tenn., drew attention to the growing market for residential pre-treating and offered practical tips to operators considering entry into this field.

"You need your truck and equipment as close to the job as you can possibly get them, since distance reduces hose pressure and cuts down the gallons per minute," Smith said. "We use drums for tanks. They're the most satisfactory, and they provide an easy way to measure gallonage. Based on one gallon of chemical for every 10 square feet, an operator uses a 50-gallon drum every 500 square feet."

Comparative Regional Costs of Sample Home Termite Job

What about cost for an average termite control job? At the conference, this was figured on a regional basis around the country. William Butts, instructor in Purdue's Entomology Department, had PCOs estimate their costs for chemical, transportation, manhours, and overhead for a job involving a 1,298-square-foot one-story home with infestations at 10 different locations. This estimate was not to include the PCO's profit.

The home to be treated had a 10′x25′ unexcavated, completely enclosed front porch with a concrete floor. A 6′x8′ rear porch was latticed and had adequate crawl space beneath it. The two porches were on opposite sides of the home, separated by an unexcavated area 15′x25′ and a half basement that measured 25′x25′. The outside walls were completely exposed for trenching except where the two porches joined the house. The wall between the excavated and unexcavated areas had the same construction as outer walls. The foundation itself consisted of three rows of uncapped concrete blocks exposed above grade. A wooden cap sill (mud sill), that supported floor joists, completely covered voids in the top course of foundation blocks. Stairs to the basement were 12′ long and 3½′ wide and were set on top of the concrete floor. Support posts were metal and stood on concrete bases.

Based on estimates PCOs made, the total average cost in the New England area was $145.75. This compared with $130.83 in the central part of the country; $104.36 in the Southeast; $173.94 in the Northwest; and $82.81 in the Southwest. The difference in wage levels from one part of the country to another accounts for the wide range in figures.

In another part of the termite program two perpendicular concrete block walls nearly six feet high were erected in Purdue's Livestock Judging Pavilion. In one wall, a hole was drilled in each of the three voids of one block just below the top course, and a red dye pumped in. At the same height on the other wall, the red dye was injected through a hole in one mortar joint. Application for both walls was based on 1 gallon of chemical for each 5 lineal feet, or roughly, 1 quart for each block.

Instructor Butts showed the flow of chemical injected at the rate of 1 gallon per 5 lineal feet into concrete block voids is more likely to penetrate toward the bottom of the basement wall, and thus nearer the footing, if holes are drilled in the mortar joint at edges of each block, rather than in each void. The same amount of chemical injected in the fewer number of mortar joints results in a greater quantity of chemical being available for dispersion down through a larger number of vertical voids, Butts pointed out.

Removal of blocks at all levels of the one, mortar-drilled wall revealed evidence of dye inside the wall. However, on the other wall, where three voids in one block had been drilled, traces of the color were barely visible in the middle of the structure, and no signs of dye could be detected at the footing.

Dr. George E. Gould, Associate Professor of Entomology at Purdue, and Jack Bready, an Entomology Department Graduate Assistant, in another demonstration showed the effect of soil and moisture in filtering out a 1% chlordane emulsion applied in loam and sand. Six 30″ plastic bags of loam soil and two plastic bags of sand were used in the ex-

Some of the PCOs who attended to make this 22nd Annual PCO Conference Purdue's largest.

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periment, and the parts per million of chlordane were measured at varying points down to a depth of 18 inches.

An attempt was made to duplicate the effect of rainfall on chemically-treated soil. During the two-week period prior to the demonstration, some of the soil samples received application of water in amounts equivalent to a normal rain. This demonstrated the leaching action of rainfall following the application of emulsion-type insecticides. Under these simulated rainfall conditions, only in sand was complete kill of test insects achieved at all depths.

A moisture gradient tube for duplicating the environmental needs of termites so the insects can be studied over a prolonged period without a major loss of original specimens, was described by Roy J. Pence of the Entomology Department, University of California, Los Angeles.

This aids in the biological and social studies of termites carried on by UCLA, the results of which were included in researcher Pence's conference review of the habits of western subterranean termites.

Closing out that portion of the conference devoted to termite control was a report on the legal structure and enforcement problems of state termite control legislation.

H. L. Bruer, Director of Tennessee's Division of Plant Industry, said such laws contain

Chemical dispersion in soil, based on preconference tests made at Purdue, was discussed at one termite session by Purdue Entomologist, Dr. George E. Gould, right, and Graduate Assistant, Jack Bready.

Other key discussions on wood insects were heard from, left to right, **(top left picture)** Ira Hatfield, Douglas MacPherson, and Dr. Eugene J. Gerberg; **(top right)** Dr. Philip J. Spear, William L. Brehm, and Dr. Leland Chandler; **(lower left)** R. M. Lindgren; and **(lower right)** Dr. Thomas E. Snyder and H. L. Bruer. "Pest of the Year" session at the conference lasted two days.

(1) a requirement for a system of licensing or certification of TOs; **(2)** an examining procedure to test qualifications of prospective operators; **(3)** provision for investigation or inspection; **(4)** requirement for correction of penalties in the event of unsatisfactory service; **(5)** a system of reporting by individual operators and **(6)** certain minimum standards.

Lab Lens Focussed on Other Wood-Destroyers

A lab class on the identification of wood-destroying insects was conducted by Dr. H. O. Deay of Purdue's Entomology Department.

Most of the insects operators viewed microscopically in Dr. Deay's class were topics of discussion at a question-and-answer session that brought together panelists Ira Hatfield of Wood Treating Chemicals Co., St. Louis, Mo.; Pence; Smith; Dr. John V. Osmun, Head of Purdue's Department of Entomology; Dr. Thomas E. Snyder, world's foremost authority on termites; and R. M. Lindgren, Chief, Division of Wood Preservation, USDA Forest Products Laboratory, Madison, Wisc.

One member of the audience asked that when cabins are being sprayed with lindane for bark beetles, should the bark be removed from logs before spraying or should the chemical be sprayed on top of the bark. Dr. Osmun answered that if the bark could be removed lindane is effective, if not the addition of 1% EDB to the lindane would increase the penetration effectiveness.

For treating a powder post beetle infestation in the studs of a home, Dr. Snyder suggested fumigation with one pound of HCN per 1,000 cubic feet or three pints of MB every 1,000 cubic feet.

Dr. Eugene Gerberg, who is with Insect Control & Research, Inc., Baltimore, Md., reviewed biology of powder post beetles and presented material similar to that contained in his May 1957 article in PC.

Wood Treating's Hatfield warned against use of water emulsions on wood, since this might lead to decay. Prescribed oil solutions include, he said, 5% pentachlorophenol, 5% DDT, 2% chlordane, ½% lindane, and ¼ to ½% dieldrin.

"One thing to remember is that finishes may be affected by the carrier used in the formulation," Hatfield said. "There is no panacea. A slow volatilizing carrier penetrates deeper into the wood and gives good control, but it is a hazard to the finish. A rapid volatilizing solvent car-

rier reduces the solubility of materials in the oil."

Douglas A. MacPherson, Extermital Co., Huntington, W.Va., reported on the progress of his yet-to-be-completed research with chlordane and pentachlorophenol for powder post beetle control. He hopes to determine with two Anobiids — **Hadrobregmus carinatus** Say and **Ptilinus ruficornis** Say — the susceptibility of wood to re-infestation after its successful treatment with either of the two chemicals.

Another wood destroyer, the carpenter ant, was covered by William L. Brehm of the B & G Co., Plumsteadville, Pa.

"Carpenter ants," he said, "will enter a home through cracks in the foundation, or through an open door, but cases are on record where they have entered residences by use of electrical or telephone lines."

Speaking on carpenter bees, Dr. Leland Chandler, of the Purdue Entomology Department, described the North American species as being black, blue, or green, with some forms having yellowish, whitish, or reddish hair on the thorax and parts of the abdomen. For the most part, however, the abdomen is relatively bare, he said.

The carpenter bee, a wood pest mildly resembling the bumble bee, is most troublesome because it **(1)** weakens timbers through the excavation of galleries; **(2)** damages wooden water tanks (especially in arid western areas), resulting in costly leaks; **(3)** causes unsightly defecation streaks on houses or other painted structures; and **(4)** is an annoyance.

In a general control discussion on wood pests, other than termites, Dr. Osmun recommended for carpenter bee control that the nozzle of the PCO's sprayer be removed and the wand inserted into the opening where the bees are entering and leaving the structure. Then, he suggested, apply an oil solution of 5% pentachlorophenol and 2% chlordane and finally caulk up the hole. A possibility for the control of adult flying carpenter bees is fogging with chlorinated hydrocarbons.

To control carpenter ant infestations with dry application, Dr. Osmun suggested treatment of the infested structure with either 5% chlordane, 2% dieldrin, or 10% DDT dust. For spraying,

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he listed 1% chlordane emulsion, 0.33% dieldrin emulsion, or wettable powders. To control infestations where the nest cannot be found, treat the ground around the outside of the building with a surface application of insecticide. One control suggestion from the floor was the use of 2% phosphorus paste.

Dr. Osmun also emphasized the importance of fungicides in conjunction with insect control. He cited particularly the mayonaise type formulations, such as, Woodtreat-TC, manufactured by Wood Treating Chemicals Co., St. Louis, Mo. It could take the place of repeated spraying, penetrates deep into the wood, and after an extended period of time leaves no noticeable residue, he said. Water emulsions might, otherwise, create a condition in the wood conducive to fungus growth.

In treating difficult cases of wood borers, Dr. Osmun indicated ethylene dibromide has been used successfully with normal oil solutions. Application of 1 to 2% EDB in small amounts in timbers creates toxic vapors that enter into galleries, where penetration of other liquid insecticides would be almost negligible. He added that the use of such a fumigant should only be under unusual cases where normal treatment will not correct the infestation.

One of the concluding speakers on the "Pest of the Year" portion of the program was Dr. Philip J. Spear, Technical Director of the National Pest Control Association. He showed slides of the principal types of borers found in the U.S. and described their characteristics. Among them were the bark beetle, flat headed borer, Eastern hemlock borer, ash borer, long horn beetle, horn tail beetle, and wharf borer.

Chemical Preview, Review

On another part of the program, Dr. Spear also reported on new chemical developments. In the field of rodent repellents, he cited Cefro (PC, Feb. '58, pg. 34), a chlorinated ethyl furoate produced by Virginia - Carolina Chemical Co. It has a toxicity comparable to DDT or lindane, he said, and is available as granules and as an emulsion, using a polyvinyl acetate as a binder or carrier. Cefro, customarily used in conjunction with a rodenticide, forces rodents from an unbaited area to a baited one. Suggested use is around stacked grains and storage sheds. The chemical has failed in many tests, Dr. Spear commented, but principally because test formulations were not appropriate for conditions of PCO use.

Another new insect repellent is diethyl toluamide. Dr. Spear described it as the best all-purpose repellent available. High meta isomer formulations include Delphene, marketed by Hercules Powder Co., and Detamide, available from the Cowles Chemical Co. Diethyl toluamide is also available from the Montrose Chemical Co. Under conditions of excessive perspiration, two applications a day should be sufficient, Dr. Spear said.

He added that label registration is expected soon for malathion to control surface feeders such as the Indian Meal Moth. It will be for dust or spray application in bins, ships' holds, etc. Its Federal tolerance is 8 ppm on whole grains and peanuts.

Another chemical described by Dr. Spear for surface feeding insects, such as the Indian Meal Moth, is Pyrenone wettable powder, a product of the Fairfield Chemical Division, FMC. Containing 20% piperonyl butoxide and 2% pyrethrins, it reportedly is easy to handle and is suitable for use on peanuts, citrus pulp, etc. Residual life is several weeks, he estimated.

Dicapthon or American Cyanamid 4124 (PC, Nov. '57, pg. 20) is a promising new insecticide, Dr. Spear said. It is on an experimental label now, and is not expected to be on the market until 1959. Dicapthon is a fast-acting and long-lasting organic phosphate with a toxicity between malathion and Dipterex, according to Dr. Spear. He said it should be useful against resistant roaches. Distribution, when it does come out, will be through the same channels as those offering malathion.

"The question of Dicapthon's odor varies widely," Dr. Spear commented. "One source says the odor is short-lived, another says it is objectionable indoors for quite some time. There were reports it leaves a yellow or brownish stain, but the company claims this has been eliminated in the newer formulation. It appears effective as a lasting residual against roaches."

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Oct. '57, pg. 26b) is another new and promising phosphate insecticide and will be available this year under the trade name of Korlan, Dr. Spear said. He feels it will be effective against resistant roaches.

Ethylene oxide is a new fumigant and sterilant that is highly volatile and flammable, the NPCA technical chief said, but it is safe at 12% concentration in Freon. It is for specialized use in enclosed containers.

A new product for control of mosquito larvae and for several moths infesting stored products is the esters of Chrysanthemumic. Dr. Spear reported it is safe and is a good residual, but the material is expensive and gives poor knockdown. It will not be on the market for some time, he said.

A new miticide included by Dr. Spear in his report is Tedion, a product of the Niagara Chemical Division, FMC. Dr. Spear said it is slow against adults, but has a very long effect against young. Tedion also has a low toxicity to mammals and to beneficial insects, and is effective against clover mites.

Sevin (7744) is a new carbamate produced by Union Carbide Chemical Co. Dr. Spear listed its LD50 to rats as 540 mg/kg. He feels it has possibilities for roach and brown dog tick control.

Sesoxane, available from Shulton, Inc., is an effective premium synergist for pyrethrins and methoxychlor, Dr. Spear reported.

He also described the NPCA's resistant roach experiments with 2% malathion, ½% Diazinon, 1% 4124, and 1% ET-14. All four were tested as water emulsions. Roaches were exposed to the insecticides on hard masonite panels, and percentage of kill was figured periodically over a 60-day period.

After two days, 82% kill was achieved with the malathion emulsion, and 100% with both Diazinon and with ET-14. Following 15 days, 85% kill was recorded with malathion, 100% with Diazinon, and 92% with ET-14. For 30 days, malathion registered 92% effective; Diazinon, 97%; 4124, 100%; and ET-14, 84%. After 60 days, malathion was 74% effective, Diazinon, 94%; 4124, 96%; and ET-14, 49%. No tests were made with 4124 after 2 and 15 days.

A similar NPCA test was made with a ½% Diazinon water emulsion to test its lasting effectiveness on various surfaces. On painted wood after two days, it was 53% effective; on linoleum, 75% effective; and on wallboard, 78%. After 15 days, it was 35% effective on painted wood; 8% effective on linoleum; and 75% on wallboard. At the end of 30 days, 60% kill was recorded on painted wood; 1% on linoleum; and 66% on wallboard. At 60 days, the emulsion registered a 24% mortality on painted wood, 5% on linoleum, and 38% on wallboard. These tests also were made with glass, but no kill was ever obtained on this surface, according to Dr. Spear.

Roach resistance talks occupied an entire afternoon on the conference program. Speakers on this topic included, left to right above, Ralph Killough of Purdue and PCOs Dr. Harlan Shuyler, Joe Watkins, and Robert Yeager. Roaches will be "Pest of Year" in '59.

Roach Research at Purdue

In roach control research at Purdue, Ralph Killough, Graduate Assistant in the Department of Entomology, described his experiments with the effect of insecticides on American roach capsules.

Insecticides and their concentrations included DDT at 2, 4, and 8%; chlordane at 1, 2, and 4%; dieldrin at 0.5, and 1%; lindane at 0.75, and 1%; malathion at 1, 2, and 4%; and Diazinon at 0.5, 1 and 2%. The carrier was acetone.

Purpose of the test was to determine the effect of chemicals on the egg capsule. Results were measured in terms of the percentage of abnormal roaches, or roaches which do not shed their first nymphal skin upon emergence, that were produced. Age of the capsule at the time of treatment was just before the hatching was scheduled to occur. Capsules were dipped for 1, 15, or 60 seconds in the chemical, or topical applications were made to the side, bottom, end, or keel. The latter is the crimped edge on top of the pocket-book-like capsule where the two sides are joined.

Highest abnormality in nymphs was recorded with lindane — 43% of nymphs were affected with abnormality. Next was Diazinon at 42%. These two were followed by chlordane, 28%; dieldrin, 26%; and malathion, 7%. DDT produced no abnormality, Killough reported.

"These laboratory conditions, of course, could not be duplicated in the field," he concluded, "since it is unlikely a pest control operator could get complete coverage of the egg, as we did when the capsule was submerged in the solution."

Dr. Harlan Shuyler, Conservation Industries, Kansas City, Kan., analyzed the changing habits and habitats of roaches as they have become resistant to chlordane.

One member of the audience asked why Oriental roaches are such a problem in building incinerators.

"Condensation builds up in the incinerator," Dr. Shuyler indicated. "This is particularly evident in sediment in broken mortar joints inside the incinerator."

Joe Watkins, Vogel-Ritt, Detroit, Mich., urged operators to adopt a more realistic perspective on the roach problem and accept it as a challenging opportunity to the industry, rather than as a damper on it.

"Two years ago we had our first experience with resistant roaches in Detroit," he said. "Since then this excuse for poor service has really been overworked. We have run tests on roaches collected from new jobs before we started and also from accounts we had been servicing and in most cases resistance was not the reason for poor control. We are still using chlordane on 95% of our jobs. Of course, we are having our resistance problems, but we do not accept resistance as an excuse from servicemen when an account gets messed up. When we suspect resistance, we have alternate chemicals which can be used successfully."

Part of the special program on roach resistance included a film made during the conference for the Department of Entomology by Purdue's Audio Visual Department, showing the correct method of treating kitchen cabinet and drawer space for roaches. Playing the part of the PCO in the film was Robert C. Yeager, Rose

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Exterminator Co., Cincinnati, O. He also presided to answer questions at the session where it was shown.

Some Flies Shun Malathion

In some areas where fly resistance is a growing problem, several operators are not even getting satisfactory results with 5% malathion solution. Dr. W. N. Bruce, entomologist with the Illinois Natural History Survey, Urbana, said baits are beginning to replace residual sprays in many such areas. He identified chief residual toxicants as Korlan, malathion, Diazinon, and Dipterex.

"Repellents," Dr. Bruce said, "could become of greater importance for moving flies from an area untreated with toxicants to another area that is treated. This would be particularly desirable in commercial establishments."

Dr. Bruce claimed rapid repellancy can be obtained by using Tabutrex, put out by Glenn Chemical Co. (PC, Feb. '58, pg. 36), and McLaughlin Gormley King's R-326. He demonstrated their effectiveness by showing how flies were repelled from treated papers inserted into boxes of flies.

Fly control and insecticides were covered by, left to right above, Dr. W. N. Bruce, S. James Henry, and Dr. Daniel L. Shankland.

In the area of larvicides, he suggested a water emulsion of 1% Thiourea, a sulfur analogue of urea. About 100 to 200 parts per million usually brings insect mortality, he said.

In fly control, the need for sanitation and prevention through proper screening was pointed up by S. James Henry of Hygienic Sanitation Co., Philadelphia, Pa. He cited the importance of proper garbage disposal; clean grease traps and drains; screening of doors and windows; use of fans at loading doors, etc. where screens are impractical; and the use of amber lights, fly traps, etc. to assist in preventing fly entry into the premises.

On inside treatment, Henry applies his residual chemical to the primary night resting sites of flies, such as walls, ceilings, lights, etc., as well as in and around fly breeding and feeding areas of the premises, i.e., garbage containers, etc.

What Happens to Insecticides?

"In addition to the economic aspect of a control problem," Dr. D. L. Shankland, Assistant Professor of Entomology at Purdue, said, "a knowledge of the fates of insecticides after they are applied is needed. This helps one predict the outcome of a control measure a little more accurately than he could otherwise. Additionally, the possible hazard to the health of the innocent bystanders is directly dependent on the fate of applied insecticide after the PCO has left."

Dr. Shankland said the principal factors affecting the fate of insecticides include the insecticide itself, its formulation, method of

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application, the physical and chemical properties of the surface to which it is applied, and climatic factors.

"There are residual deposits which last for years, such as those indicated in Hetrick's (1957) work," Dr. Shankland said. "Here, BHC, chlordane, dieldrin, aldrin, and heptachlor, mixed with soil, are, after 7 to 10 years, still killing subterranean termites. There are residual deposits effective for intermediate periods, such as those of chlorinated hydrocarbons applied to exposed surfaces. Residues of relatively short duration are associated with the plant derivatives: pyrethrins, nicotine, and rotenone. Finally, there are those insecticides which undergo chemical conversions to different, but still insecticidal compounds.

Bat Habits

Another Purdue Entomology Department member, Nixon Wilson, described the habits of bats, which usually colonize in atties, eaves, etc. Colonies vary in size up to 1,000 members, and have reached the size of 10,000 in some instances, Wilson noted.

Five Steps to Ectoparasite Control

The movement and control of these bat ectoparasites, as well as ectoparasites found on rodents and birds, were described to conferees by Dr. Harry C. Pratt, of the U. S. Public Health Service's Communicable Disease Center, Atlanta, Ga.

Dr. Pratt divided the control of such ectoparasites into five steps: accurate identification of ectoparasites; determination of true source of infestation; elimination of the host, if rodent, bat, or bird; selection of correct insecticides; and thorough coverage with the correct insecticide at safe and effective concentrations.

For control of bat bugs, common bedbugs, chimney swift bedbug, swallow bug, and the Mexican bedbug, Dr. Pratt recommended a standard 5% DDT spray applied at a rate of about 1 gallon per 1,000 square feet of space.

"Where 5% DDT sprays are not effective, other standard insecticides, such as 0.5% lindane and 2% malathion, may be used for a wide variety of bird ectoparasites, including fowl ticks, chicken mites, fleas, and bedbugs. As a last resort, in buildings which can be made reasonably tight, fumigation with Hydrocyanic gas may be used, but only by a competent and licensed fumigator," Dr. Pratt commented.

Chemical control for the chicken mite and northern fowl mite includes use of pyrethrum sprays applied to the surfaces on which the mites are crawling. This should be followed by a clean-up with a vacuum cleaner.

Then all infested areas may be treated with residual applications of insecticides to obtain a prolonged kill. Such insecticides listed by Dr. Pratt were 1 to 5% DDT sprays, 0.5% lindane, 2% chlordane, DMC, Aramite, and 1 to 4%malathion. He said excellent control has been obtained with 1 to 4% malathion, while 1 to 5% DDT sprays have yielded variable results.

Bird Nuisance Not On Wing

In a special program devoted to bird control, Galen Oderkirk, U. S. Fish & Wildlife Service District Agent, West Lafayette, Ind., covered mainly pigeons.

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Bird or bat control or the movement, habits, and control of ectoparasites were the conference subjects handled by the speakers, pictured left to right above: William D. Fitzwater, Art Gibson, Dr. Harry Pratt, John Beck, Nixon Wilson, and Galen Oderkirk in one morning-long session.

ing several diseases and poultry lice and straw mites, pigeons create a major nuisance by frequently plugging up drains and jamming up air conditioning vents, with their excretion, and by generally defacing buildings, etc.," Oderkirk remarked. "They usually do their nesting and night roosting up in belfries or towers of Gothic-styled buildings."

He said the recommended poison bait material contains four parts of corn to one part of wheat. Seeds are usually preferred for trap baiting.

"Before undertaking bird control work, however, check with your state game department for state regulations pertaining to the removal of birds or methods of control. Likewise, check local ordinances in cities in which work is done. There are no Federal regulations protecting nuisance pigeons, European starlings, and English sparrows. However, if a migratory bird, protected under Federal law, is killed in the process of removing a nuisance species, a person would be subject to the penalties imposed by Federal law."

John Beck, USF&WLS, District Agent in Columbus, O., suggested there are four principal types of bird control: lethal, repellent, frightening, and remedial construction. He reported experiences that he has had with most of them.

He described the case of an ultra-modern drive-in restaurant in Columbus invaded by about 800 to 1,000 sparrows, which were roosting on exposed metal girders or supports of the structure. Beck said when he first visited the establishment, droppings were about one inch thick on the sidewalk and at other points.

When the owner agreed to Beck's offer to control the birds, the USF&WLS Agent pre-baited the roof with cracked corn, wheat, and bread crumbs. This would help determine what the birds would take as bait, and also would draw them away from the girders. He settled on a combination of oats, wheat, and cracked corn for bait, and strychnine as the poison. This was placed on the roof and at ground levels at one end of the parking lot. Total kill, he said, was about 600 or about 75% of the total.

As a standard bird control bait formulation, William D. Fitzwater, USF&WLS Assistant District Agent, West Lafayette, Ind., recommended the following when the use of poisons is permitted:

Baking Soda	1 oz.
Gloss Starch	3 oz.
Corn, Wheat	12 lbs.
Strychnine	1 oz.
Water	1 pt.

Sentinel Laboratory's Art Gibson spoke to conferees on bird repellents or "entanglants" of sticky composition.

"Bird repellent materials on the market today can be classified as either semi-solids or liquids," Gibson said. "Many of the semi-solids are jellied oil, although some are more accurately described as plasticized gums. The term 'jelly' would seem to cover the semi-solid products as well as any other term. The liquids are usually oil or water base and applied by spraying and so may be designated as sprays.

"Application of the more widely - used jelly entanglant, available in the bulk or 1-pound tubes, is usually with a 10" caulking gun. The material is applied on ledges in a bead about ½" from the outer edge. Another line is applied ¾" back of this. On extra wide ledges, several lines must be applied; or in some cases a line at the front and another at the back of the ledge with an "S" line between them is used. In our experience, individual lines are the most effective and take about the same amount of material.

"For roofs or other flat areas, spray material is used," he stated. "This can be applied either with a hand compressed sprayer or a power sprayer. Other equipment possibly needed, depending upon the size of the company, includes a truck with a ladder rack, if necessary, extension ladders, hook ladder, a bosun chair; warming oven for keeping material flowable in winter; scrapers; wire brushes; ropes; caulking guns; and a whisk broom.

"Practically every commercial building in your area is a potential roosting place for some types of birds," Gibson stressed.

Bait-Shy Rats

In a swing to the topic of miscellaneous animal problems, Fitzwater suggested an occasional shift or change in a food base might help the PCO overcome rat bait shyness.

Preliminary tests conducted with O. E. Linck Co.'s Purple Death, he said, indicate it is poorly accepted. It reportedly took 3½ grams of Purple Death to kill a 250 gram rat.

Chief anticoagulants on the market now, as Fitzwater listed them, include warfarin, Fumarin, Pival, PMP, and Diphacin. In some recent USF&WLS tests, he said Fumasol-A proved to be more effective than any other water soluble anticoagulant. Under similar tests, sugar-treated sodium forms of anticoagulant water baits were accepted 1½ times over plain tap water.

Necrosis-Causing Spider

Spider control was discussed

Venomous animals and spiders were reviewed by left to right, Drs. S. Minton and C. Wingo.

Communication speakers included, left to right, Roland MacGrain, Dr. Lee Truman, R. O. Williams, and Dr. E. R. Ryden. They are pictured above with PCO Harlem Ives, right.

by two speakers: Dr. Curtis Wingo, Associate Professor with the Department of Entomology, University of Missouri, and Dr. Sherman Minton, Jr., Indiana University Medical Center, Indianapolis.

Dr. Wingo described his research with **Loxosceles reclusus,** a common brown, Midwest spider whose bite causes a Necrotic reaction in its victim. The bite itself becomes ulcerated, the dead skin is gradually sloughed off, and a permanent scar remains behind.

Dr. Minton discussed venomous animals and spiders other than **Loxosceles reclusus.**

Panel on Communication

A special panel on communication between employers, employees, and customers was chaired by Professor E. R. Ryden of Agricultural Extension and Education, Purdue. In addition to Professor Ryden, speakers included Roland MacGrain, Vogel-Ritt, Detroit, Mich.; R. O. Williams, R. O. Williams Co., Evansville, Ind.; and Dr. Lee Truman, Pest Control Services, Inc., Indianapolis, Ind.

First-Day Prepping

Classes in basic entomology and principles of pest control for newcomers attending their first or second Purdue Conference were held the first day of the conference. This instruction covered insect biology, recognition, and chemical control, plus identification of insect and rodent damage. In charge were Professor Glen E. Lehker, Purdue Extension Entomologist; Dr. John V. Osmun, chief of Purdue's Entomology Department; and Dr. B. E. Montgomery, Dr. H. O. Deay, and Professor Emeritus J. J. Davis, all of the university's Entomology Department. For veteran conferees, first day classes, concerned with the more advanced aspects of subjects taught newcomers, were given by W. D. Fitzwater, USF&WLS Assistant District Agent; and Dr. H. O. Deay and Dr. Leland Chandler, both of the Purdue Entomology Department.

Meeting Pilot Committee

Conference planning committee for this year's Purdue meeting consisted of chairman Robert C. Yeager, Rose Exterminator Co., Cincinnati, O.; Arthur W. Gibson, Sentinel Laboratory, Springfield, Ill.; Wendell V. Jordan, Federal Chemical Co., Indianapolis; John D. Mock, Arwell, Inc., Waukegan, Ill.; and Joseph A. Watkins, Vogel-Ritt, Detroit, Mich. The committee worked with Dr. Osmun to stage a program which attracted more delegates than any other in the past 22 years.

The 1959 Purdue Pest Control Operators Conference has been scheduled for Jan. 26-30. Cockroaches have been tentatively selected as "Pest of the Year" for the meeting.

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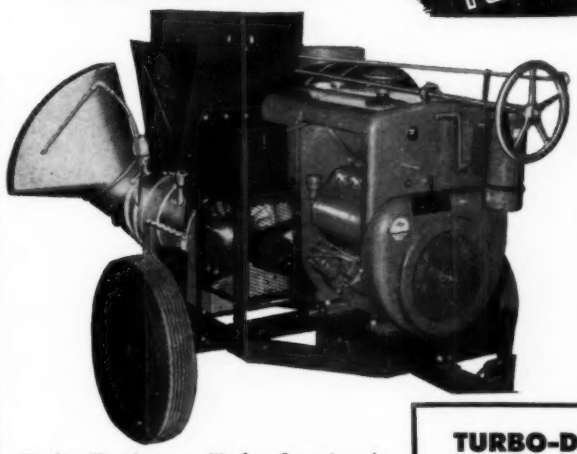

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Some of the more than 80 members of the Oklahoma Pest Control Operators Association who participated in the association's annual conference Jan. 30-31 are shown above.

Oklahoma PCOA Conferees Hear of New Hormone Insecticide Research

The recent discovery that insects can be killed by giving them a dose of the hormones they normally secrete has created a whole new field of insecticide research, Oklahoma State University's Professor of Chemistry Dr. H. P. Johnston told over 80 members and guests of the Oklahoma Pest Control Operators Association at its 1958 meeting in Stillwater Jan. 30-31.

Addressing the association's eighth annual conference, held at OSU, Dr. Johnston said there is no creature known that can develop immunity to its own hormones. An overdose, he indicated, upsets the delicate balance of life functions within the body.

Conference discussions ranged from Dr. Johnston's review of insecticide chemistry to control of vectors, termites, and resistant household pests, including roaches. Also highlighting the program was a lab session on insect identification, directed by the university's Department of Entomology; and a review of the Oklahoma Termite and Pest Control Law, by James Rogers of the Department of Entomology and Plant Industry, Oklahoma State Department of Agriculture. Rogers is Assistant Administrator of the Oklahoma Structural Pest & Termite Control Act.

On the national scene, relative to termite control, W. L. Anderson of Oklahoma City, the Federal Housing Administration's Chief Architect for the state, said the FHA's new, revised Minimum Property Standards for termite control on FHA-financed homes will apparently be distributed about July 1 and become effective October 1. He outlined what he thinks operators might generally expect in the way of pre-treatment specifications under the revised MPSs. These were essentially unchanged from those recommended by the BRAB report in 1956. (PC, July '56, page 46). Harold Schnorrenberg, Dead Shot Chemical Co., Oklahoma City, and William I. Elo, Pest Exterminators Co., San Antonio, Tex., also reported on industry efforts to obtain certification for operators engaged in termite soil pretreatment (PC, Nov. '57, page 19).

Another part of the termite portion of the program was a talk by Raymond E. Means, OSU Professor of Architecture, on the soil changes often responsible for slab breakage and the eventual entry of termites into the home through the slab breach.

"When clay soil fills with water," Professor Means explained, "the soil swells and the resulting stresses may fracture the concrete slab. An opening of only 1/32 inch is sufficient for termites to gain entry. Clay soils damage buildings more frequently than sandy soils in this respect, since clay swells and increases in volume after becoming wet."

In a report on Oklahoma's first known infestation of drywood termites last year (PC, Nov. '57, page 37), Professor G. A. Bieberdorf of the OSU Entomology Department said he felt the state's climate is not suited for major infestations of **Kalotermes minor.**

"However," he commented, "wooded areas with a heavy rainfall in Eastern Oklahoma might be suitable for **Reticulitermes hageni.**"

Insect Resistance

During a panel discussion on insect resistance, Professor Bieberdorf said no termites in Oklahoma have demonstrated resistance to chlordane or any of the other chlorinated hydrocarbons. Dr. D. E. Howell, head of OSU's Entomology Department and a member of the panel, added that since the queen termite normally would not come into contact with the insecticide, resistance would be slow to develop.

During the same question-and-answer period, panelist J. Earl Griffin of Aggie Chemical Co., Tulsa, commented that a poison bait which ants can carry back into their tunnels probably would be best for treating ant infestations involving slab type construction. Dr. Howell stressed the necessity for a PCO to know exactly what type of ant he is dealing with before he selects his bait.

Also participating on the resistance panel were Clayton Wright of B & G Co., Dallas, Tex.; Dewey Bedingfield, Getz Exterminators, Inc., Oklahoma City; and Professor Manning Price of Texas A & M College, College Station, Tex.

The origin of such resistance among insects was discussed by Dr. Howell.

"Many insects develop resistance by changing their habits," Dr. Howell said. "Flies that are resistant may be those which do not crawl as much as other less resistant strains, and thus do not get sufficient amounts of insecticide on them to kill."

Dr. Howell also listed several physical changes that might explain resistance. The insect may secrete a waxy body coating that

the insecticide cannot penetrate, or the exoskeleton or outer covering of the insect, he said, may thicken. Also, the insect might develop long hairs on the legs which keep skin surfaces out of contact with the insecticide.

Another way he feels insects might become resistant would be for them to store the insecticide in a part of the body, such as in fatty tissue, that is not used. Or the toxic substances in the chemical may affect one of the insect's body systems without affecting another. The second, unaffected system could then take over some important function previously carried out by the damaged system, such as the transfer of oxygen from one part of the body to another, etc.

"Another possibility is that insects may have the ability to breakdown the insecticide into comparatively harmless material," Dr. Howell continued. "An enzyme may be added to the insecticide to halt this breakdown, and the insect might then develop ability to breakdown the enzyme."

Resistance, he said, is the result of mutations or sudden changes in the heredity of the insect. Such changes may be the result of cosmic rays from the sun, presence of radioactive dusts, heat, X-rays, or unknown causes.

"Insects which have developed resistance do not revert back to the non-resistant form, except when the resistance may be a disadvantage to the insect in its 'normal' life," he concluded. "For the PCO, the answer is to switch from one class of insecticide, as soon as insects show resistance, to another class with which they have had no contact. Resistance to one class of insecticide, such as the chlorinated hydrocarbons, means the insect also can resist others in that class. Another approach is the use of systemic poisons."

In reporting on results obtained in Texas with insecticides on resistant insects, Professor Price said malathion had yielded good results against resistant fleas and mosquitoes, while Diazinon was being used successfully against resistant brown dog ticks. B & G's Clayton Wright also described control results obtained in field experiments against resistant insects.

Other programmed talks were heard from Aggie Chemical Co.'s J. Earl Griffin on business; and from R. H. Waldrop, Demonstration Project Technical Advisor for the Oklahoma State Department of Health, on the need for sanitation and education in fly and mosquito control.

New Oklahoma PCOA officers elected at the conference include, left to right, A. M. McIntosh, vice president; Wilson D. Hand, president; and Tom Graham, who was re-elected secretary-treasurer for '58-'59.

Hand Elected for '58-'59

During the association's annual election of officers for fiscal '58-'59, Wilson D. Hand, Hand Exterminating Service, Oklahoma City, was elected president, and A. M. McIntosh, A. M. McIntosh Termite Control Co., Tulsa, vice president. Tom Graham, Graham Pest Control, Oklahoma City, was re-elected secretary-treasurer.

Plaque to Schnorrenberg

An added highlight of the conference this year was the presentation of a plaque to Harold Schnorrenberg, a member of the NPCA Executive Board. It was handed to him by Graham, on behalf of the Oklahoma association, in recognition of Schnorrenberg's role in organizational activities on both state and national industry levels.

A plaque, commemorating his service to the pest control industry on both state and national levels, was presented to Harold Schnorrenberg, right, by Tom Graham, in behalf of the membership of the Okla. PCOA.

Midwest Pest Control Meeting Set For March 10-11 in K.C.

The Central Midwest District Pest Control Meeting, formerly called the Four-State Pest Control Conference, will be held at Town House Hotel, Kansas City, Kans., March 10-11.

According to General Meeting Chairman Robert Schendel, speakers engaged for the program include Ira Hatfield, Wood Treating Chemicals Co., St. Louis, Mo.; Robert M. Russell, Orkin Exterminating Co., Atlanta, Ga.; Dr. Lee Truman, Pest Control Services, Inc., Indianapolis, Ind.; Clayton Wright, C. Wright Associates, Dallas, Tex.; A. W. Gibson, Sentinel Laboratory, Springfield, Ill.; and William Ives, Rose Exterminator Co., Detroit, Mich.

The $8 registration fee includes the cost of the banquet the first night of the conference.

For more details, contact either Robert Schendel at Schendel Pest Control, 1018 E. 6th St., Topeka, Kans.; or local chairman, Dr. Harlan R. Shuyler, Conservation Industries, Inc., 3138 State Ave., Kansas City 2, Kans.

MSU Spring Conference

Wood-infesting insects and fungi will share the stage at the annual Spring Pest Control Conference at Michigan State University in East Lansing, March 20-21.

Sponsored by the MSU Entomology Department, the Michigan Pest Control Operators Association, and the (Michigan) Wolverine Pest Control Association, the conference will be held in MSU's Kellogg Center.

Speakers programmed are E. S. Beneke, J. R. Hoffman, Dr. Gordon Guyer, James Butcher, Ray Janes, and Forrest Strong, all from Michigan State University; William D. Fitzwater, U. S. Fish & Wildlife Service, West Lafayette, Ind.; A. A. Canfield, Wayne State University, Detroit; Dr. Mitchell R. Zavon, University of Cincinnati; Dr. Ralph E. Heal, Executive Secretary of the National Pest Control Association; William Ives, Rose Exterminator Co., Detroit, Mich.; Giles Isham, Van Core Pest Control Service, Lansing; and Ike Rogner.

For more details write MSU's J. R. Hoffman, Associate Professor, Department of Entomology.

Resistance Should Bring Price Lift For Roach Customers, Eastern Conference Told

A price umbrella should never be held over the customer who has resistant roaches. When service costs of the PCO are increased as a result of more frequent and more thorough treatment on jobs where resistance is suspected, the problem should be explained to the customer and a logical, sensible price adjustment made to offset added service expenses.

This was a key thought injected into the 18th Annual Eastern Pest Control Operators Conference Jan. 22-24 at the University of Massachusetts in Amherst. Over 150 PCOs, suppliers, and university and government leaders were on hand for the three-day program, arranged by the NPCA's Eastern Conference Committee Chairman, Sidney Wimmer (Majestic Exterminating Co., New York, N.Y.); and the university's Dr. C. P. Alexander and Dr. Frank Shaw. Dr. Alexander is head of the Entomology Department, and Dr. Shaw is a department member.

In addition to related panels on resistance and business, the program included a special demonstration of equipment assembly and repair, by Charles Houghton, Safety Fumigant Co., Boston; and classes on rodents, safety, business, insect identification, and wood-destroying organisms.

Participating on the business panel were its chairman, Jacques J. Hess, Exterminating Services Corp., New York, N. Y.; James B. Ludtke, University of Massachusetts; Mark Weintraub, Astor Exterminating Co., Cambridge, Mass.; and Robert Kofoed, Fogging Unlimited, Inc., Red Bank, N. J. On the resistance and insecticide panel were chairman Richard Keenan, Waltham Chemical Co., Waltham, Mass.; Dr. John Lembach, Residex Corp., Linden, N. J.; John A. Fluno, Entomology Research Division, Agricultural Research Service, USDA, Washington, D.C.; Dr. Arthur Muka, Entomology Department, Cornell University, Ithaca, N. Y.; and Dr. Philip J. Spear, Technical Director of the National Pest Control Association.

"To do a good job and still make a fair profit on roach jobs, the operator confronted by resistance must know what species he is working with and the habits of that particular species," a member of the resistance panel emphasized.

To help PCO-conferees in this identification and recognition phase of their work, a special laboratory session was conducted by Dr. Alexander and his staff. This was supplemented by a talk on roach recognition from Dr. Marion E. Smith, of the Mass. U. Entomology Department; and another address on the ecological and physiological requirements of roaches. The latter was presented by Dr. David Pimental, Assistant Professor of Insect Ecology at Cornell University.

Insect Ecology, Physiology

"Ecology, broadly speaking, is a study of the survival of organisms in their environment, while physiology is a study of the function of the parts of an organism," Dr. Pimentel explained. "Since the cockroach is a living organism, it has in general the same ecological requirements for survival that all life on earth has. These requirements are: **(1)** energy, **(2)** matter, and **(3)** suitable environment."

Dr. Pimentel said American and German cockroaches have been observed to feed on foods high in carbohydrate value, such as bread, flour, starch, sugar, honey, corn flour, bran, banana, potatoes, and carrots. And they sometimes eat substances high in protein, such as glue, casein, and dried skim milk. He listed the optimum temperature range suitable for German and American roaches as 65°F to 80°F, adding that they cannot maintain their populations at a continuous low reading of 55°F. or a continuous high temperature of 105°F. Both species are killed, he said, by just a few minutes exposure to temperatures below freezing or temperatures at 120°F. or above.

"In homes, cockroaches protect themselves against excessive moisture loss by living in microenvironments of high relative humidity, such as the water pipes close to the sink region or in areas where water is splashed and leaks into the crevices available to them," Dr. Pimentel said.

"In addition, the humidity in these small spaces is further increased by moisture loss from the many insects crowded into the small space. The more dense the population in a space, the less the moisture loss from each individual. This mutual cooperation in each of these species allows them to survive as a population whereas one or a few individuals might not. The water for drinking is found in sinks, water closets, leaking pipes, sweating pipes, and fresh and juicy fruits and vegetables like bananas and potatoes."

Wood Insects, Rodent Panels

Discussing termites and other wood-destroying organisms at the conference was a panel composed of Philip Mayer, Evins Exterminating Co., Great Neck, N.Y., chairman; Raymond H. Bigelow, Astor Exterminating Co., Cambridge, Mass.; Robert Troup, Harder Extermination Service, Hempstead, N.Y.; Robert Trenary, R. H. Young & Associates, Paterson, N. J., and the NPCA's Dr. Spear.

Another control panel covered rodents. On it were chairman Joseph Harris, Guarantee Exterminating Co., New York, N. Y.; Howard Merrill, U.S. Fish & Wildlife Service, Boston, Mass.; L. O. Anderson, Berg Extermi-

(Continued on page 65)

Chilly New England weather didn't keep Eastern Conference delegates from posing for a picture.

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First Non-LSU Southern Conference Attracts 150 to Shreveport, La.

About 150 attended the 18th annual Southern PCO Conference held, in cooperation with the National Pest Control Association, at the Washington-Youree Hotel in Shreveport, La. Feb. 3-4. This was the first year in the history of Southern PCO Conferences that sessions were not conducted at Louisiana State University in Baton Rouge.

Dr. O. W. Rosewall, retiring LSU professor of Entomology, was the principal liaison between LSU and the hotel-centered conference. Chairman of past LSU conferences, Dr. Rosewall reviewed their history at this year's meeting.

In the technical phase of the program, Dr. Philip J. Spear, NPCA Technical Director, revealed latest information on new chemicals designed to cope with insect resistance problems. (See Purdue Conference story, page 36). A panel composed of PCOs also explained how the industry is combatting insects that refuse to yield to conventional control methods. Upshot of the discussion was the revelation that more dusts are being used for control and treatment of wider areas is needed. Panelists included William Elo, Pest Exterminators Co., San Antonio, Tex.; W. L. Seale, Seale Pest Control Corp., New Orleans, La.; James Sims, Cardinal Pest Control, Montgomery, Ala.; Louis Havard, Havard Pest Control Service, Hattiesburg, Miss.; and Noad Corley, Corley Pest Control, Dallas, Tex.

A survey of service vehicle usuage in the South was made by Herman Fellton, president of Getz Exterminators, Inc., St. Louis, Mo., and results were presented at the conference by Fellton through slides and a verbal report.

Results of a similar PCO-conducted survey on the comparative cost of doing business in the Southern area were reported to conferees by Truman Thomas, Anti-Pest Co., Shreveport. Tied in with Thomas' talk was another by Frank H. Hagaman of Jackson, Miss., a Certified Public Accountant. Hagaman covered principles of income and expense statements and showed operators how to better detect hidden costs.

On the termite phase of the conference, NPCA Executive Secretary, Dr. Ralph E. Heal, discussed progress of the FHA certification program and revealed regular meetings are underway between the NPCA and the Government agency in an effort to make soil pretreatment a part of the FHA's loan requirements.

A field demonstration on termite treatment of an existing, floating-slab within a brick foundation was conducted by Myron W. Smith, Hill-Smith Systems, Memphis, Tenn. He was assisted by J. Homer McBride, Burmac Termite Control Service, Shreveport. Dieldrin was the soil toxicant used.

Another key segment of the program was a laboratory session on ant identification, organized largely by Dr. Richard K. Spears, Jr., Associate Professor of Botany and Forestry from Centenary College, Shreveport, La. Dr. Heal and Myron Smith chaired the ant program, at which a special folder, consisting of a three-page key and 19 pages of illustrated charts, was distributed to aid in ant identification. Illustrations used were designed by Dr. Marion Smith, University of Massachusetts, and provided delegates at the Eastern PCO Conference several years ago. The folder will be made a part of the NPCA's Technical Release series at some future date.

James Bartlett, Gulfport, Miss. U.S. Department of Agriculture expert on fire ants, which are a serious pest in the South, outlined fire ant control procedure and stressed the need for accurate identification of these largely agricultural pests.

New rodent control measures were reviewed by Robert M. Russell, Technical Director for the Orkin Exterminating Co., Atlanta, Ga. Display material for his talk was furnished by H. F. Sessums of the U.S. Fish & Wildlife Service, State College, Miss.

Conference chairman was G. L. Edwards, Redd Pest Control, Jackson, Miss.

Although no date has been set for the 1959 Southern Conference, industry members report it probably will be held following the Purdue Conference and in approximately the same section of the country as this year's.

NC Short Course Staged in Raleigh, Feb. 4-6

More than 115 PCOs joined in the eighth annual Pest Control Operators Short Course at North Carolina State College in Raleigh, Feb. 4-6.

Sponsored jointly by the North Carolina State College Division of College Extension and the North Carolina Pest Control Association, the short course featured one full day of lab classes on rodent and ant identification.

Program speakers included NC State College's J .B. Funderburg, S. V. Kage, D. A. Young, G. D. Jones, H. E. Scott, C. F. Smith, W. M. Kulash, and L. W. Nielsen; A. L. Pickens, Charlotte; the U. S. Forest Service's R. J. Kowal and H. R. Johnston; C. C. Johnson, Larvacide Products, Inc., Ringwood, Ill.; E. D. Wilber, American Cyanamid Co., New York, N. Y.; and Dr. Ralph E. Heal, Executive Secretary of the National Pest Control Association.

New NCPCA officers elected at the recent PCO Short Course in Raleigh are, left to right, seated, James E. Hutto, Orkin Exterminating Co., Rocky Mount, president; Delia Copley, Tar Heel Exterminating Co., Inc., Durham, executive secretary; David Dodd, Jr., Carolina Chemical & Pest Control Co., Monroe, vice president; and, left to right, standing, Adrian Gaynor, National Exterminating Co., Inc., Greensboro, secretary-treasurer; A. G. Killough, Killo Exterminating Co., Charlotte, director; and H. E. Frye, Frye Exterminating Co., Raleigh, director. Two other new directors — D. R. Nimrocks, Terminix Company of North Carolina, Raleigh, and Roy Goforth, Arrow Exterminators, Inc., Fayetteville, were not present when the above picture was taken.

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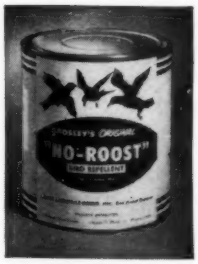

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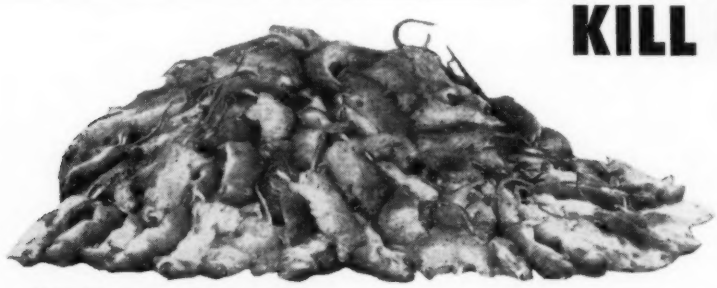

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UCLA Termite Research With Chemical, Physical Barriers; Inert Diluents

by WALTER EBELING, ROY J. PENCE, and ROBERT E. WAGNER
Department of Entomology, University of California, Los Angeles

Structural pest control research at UCLA comprises concurrent field and laboratory programs. The field program has been carried out in subdivision tracts throughout southern California in former citrus orchards where uniform preconstruction conditions are to be found.

Field Research on Chemical or Physical Barriers Against Sub Termites

In each tract, the soil on seven lots was treated, each with a different insecticide directed against western subterranean termites. This was done in 12 tracts where slab-on-ground construction was used and in 10 tracts where there was conventional (joist-type) construction. The houses, along with untreated checks in each tract, will be periodically examined for incidence of termites for the next 10 or 15 years.

In preconstruction treatments, insecticides have also been added to asphalt emulsion and sprayed on the ground to form a combination termite and vapor barrier. Also sand and cinders of a particle-size range of 10- to 16-mesh have been used as termite barriers. Sometimes asphalt emulsion is sprayed on the barrier to combine vapor control with termite control. This work has been done in tracts where the treated houses may be compared with untreated ones in such a way that statistically sound comparisons can eventually be made.

Laboratory Research on Subterranean Termites

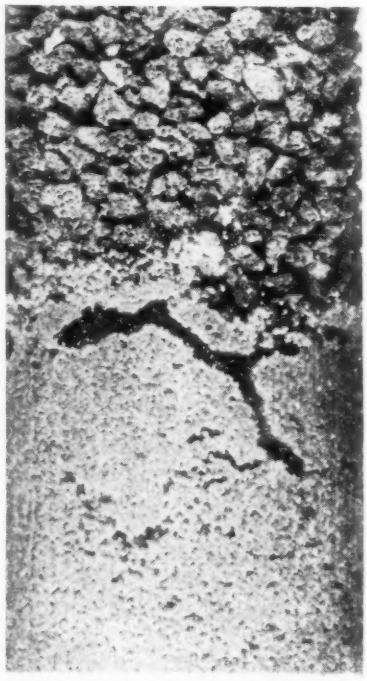
In the laboratory research program, soils treated with a wide variety of insecticides were tested for (1) their direct effect on termites placed in contact with them and (2) as barriers to termites burrowing upward in columns of untreated soil. The period for 50% immobility or paralysis of the termites (MPI) and period for 50% mortality (MLP) were determined for 9 insecticides.

With the MPI as a criterion, and at 1% concentrations, the insecticides ranged in decreasing order of effectiveness as follows: lindane > DDT > dieldrin > chlordane > pentachlorophenol > toxaphene > sodium pentachlorophenate > sodium arsenite. At 0.12% concentration and lower, the order of effectiveness was lindane > dieldrin > chlordane > DDT > toxaphene > pentachlorophenol > sodium pentachlorophenate > sodium arsenite.

With the MLP as a criterion, and at 4% concentration, the order of effectiveness of the insecticides was pentachlorophenol = sodium pentachlorophenate > lindane > DDT > sodium arsenite > toxaphene > dieldrin > chlordane; at 1% concentration the order of effectiveness was pentachlorophenol > sodium pentachlorophenate > lindane > DDT > dieldrin > toxaphene > chlordane > sodium arsenite; at 0.12% concentration the order of effectiveness was pentachlorophenol > lindane > DDT > dieldrin > toxaphene > sodium pentachlorophenate > chlordane > sodium arsenite.

The laboratory experiments showed that the relative effectiveness of the insecticides depended much on whether the MPI or the MLP was used as a criterion of effectiveness. Lindane was outstanding for rapid paralysis (MPI) and pentachlorophenol was outstanding when the death of the termites, as based on complete cessation of movement of the appendages (MLP), was used as the criterion of effectiveness.

Relative effectiveness of the insecticides also varied with decreasing concentration. With either MPI or MLP as the criterion, the relative effectiveness of the insecticides was different at different concentrations. Lindane, dieldrin, and chlordane were relatively more effective, in relation to the other insecticides, as the concentrations of insecticide in the soil were decreased. Since decrease in the amount of toxicant in the soil caused by aging would presumably have the same effect as dilution of fresh soil samples, the superior performance records of lindane, dieldrin, and chlordane in actual commercial practice and in long-term experimentation (Hetrick, 1957) may be related to their ability to stand dilution without corresponding decrease in effectiveness. Pentachlorophenol, sodium pentachlorophenate, and sodium arsenite were the insecti-



A termite barrier composed of cinders with the particles ground down to 10 to 16 mesh is illustrated above, as photographed in a UCLA laboratory. The barrier is shown over fine sand, which UCLA researchers consider a good medium for termites. Note the termite tunnels that extend up to the cinder barrier and stop, reflecting unsuccessful attempts by these wood pests to penetrate the cinders.

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cides most seriously affected by dilution.

Termites can be kept alive in fine sand, moistened by capillarity, in glass test tubes (Pence, 1957). These termites burrow upwards immediately if untreated soil is placed above the original column of infested soil. However, if the soil is treated with 1% concentrations of the common insecticides, the termites will not penetrate the treated soil. Treated soils will be kept for an indefinite number of years to be tested periodically in this manner. Among soils that had been treated for 16 months, dieldrin was the only insecticide that was able to kill subterranean termites below the area penetrated by the insecticide, apparently by means of its vapors.

Effect of Inert Diluents Against Drywood Termites

Research has continued on the control of the drywood termite, primarily with the aim of finding a dust that may be applied to rough framing of houses under construction or the insides of attics of newly constructed houses, or houses that have been recently fumigated, as an insurance against reinfestation.

Ebeling and Pence (1956) placed treated blocks of wood in an attic to determine their toxicity to termites after prolonged periods. DDT, chlordane, lindane, dieldrin, toxaphene, pentachlorophenol, sodium fluosilicate, and cryolite were applied in these experiments. In 17 months the insecticide residues were effective only where the insecticides had been applied as dusts. Other formulations, which left no inert residue, had lost their effectiveness completely. This indicates that the diluents used in the dusts remained effective after the toxicants had lost their toxicity through decomposition.

Following this observation, a wide variety of inert dust diluents were applied to blocks of wood, in very light applications, and alates of drywood termites, with wings clipped, were placed on them. The more effective dusts killed the termites in 3 or 4 hours. The inert dusts, probably by the combined effect of abrasion and absorption, remove or disturb the lipids of the epicuticle to such an extent that the termites suffer a rapid water loss and die from desiccation. The literature reveals no example of an insect being as sensitive to the effect of inert particles as was found to be the case with termites.

The most encouraging aspect of this work has been the finding that certain diluents are more effective in killing the termites crawling over the dusted wood than fresh applications of the insecticides generally used in termite control. The most effective diluents in this respect were Olancha DM Clay, Pikes Peak Clay 9566, Attaclay, and Diluex A. The lack of toxicity to humans, and the fact that these materials would not be subject to a gradual decrease in effectiveness after application, result in their being particularly promising as a means of long-term prevention of attacks of drywood termites.

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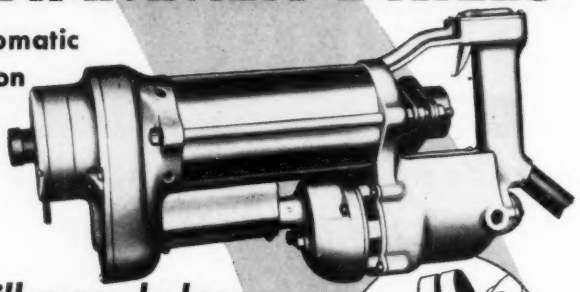

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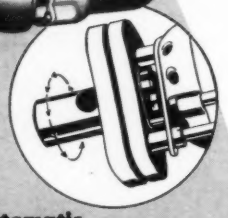

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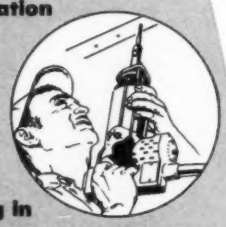

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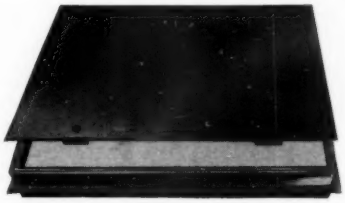

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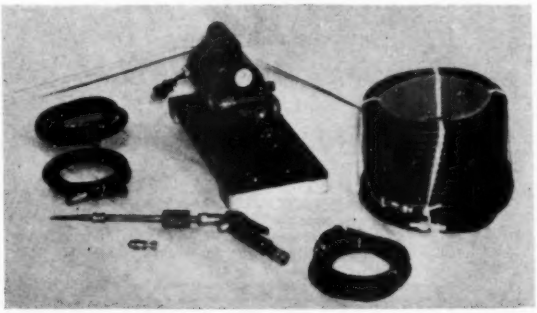

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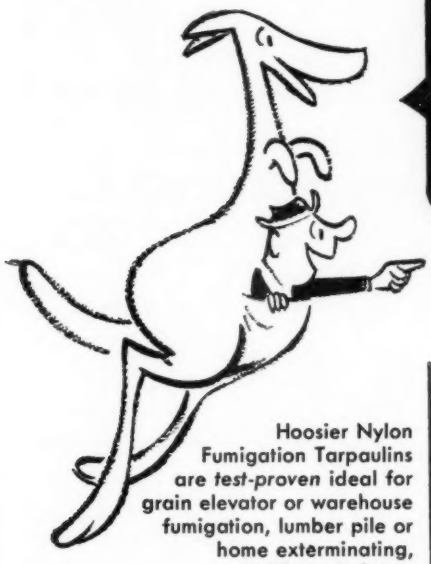

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Exclusive *NEW* design
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For drilling without binding in GREEN CONCRETE, MARBLE or other HIGH-BULKING MATERIALS

- Long, high capacity spiral grooves efficiently remove bulking material from cutting zone.
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Gentlemen: - Kindly send me a copy of the "WHAT and HOW" Manual.
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Chemically-Treated Asphalt Vapor Barrier Stops Termites

Experiments conducted by Roy Pence in the Department of Entomology at the University of California, Los Angeles, indicate asphalt used for vapor barriers in slab houses, may be treated with a termite toxicant to stop the wood eaters.

Layers of asphalt from emulsions or "cut back" solutions of asphalt, such as are used as vapor barriers in slab-on-ground construction, were placed on termite infested sand in Pence's study. Termites attempted to bite their way through the asphalt layers, but since they did not concentrate their attack at any single point, it required three or four weeks for them to make their way through a 1/8 inch layer of asphalt.

When 1% of such chlorinated hydrocarbons as chlordane, DDT, dieldrin, lindane, methoxychlor, or toxaphene was incorporated into the asphalt, the termites did not attempt to penetrate the layer.

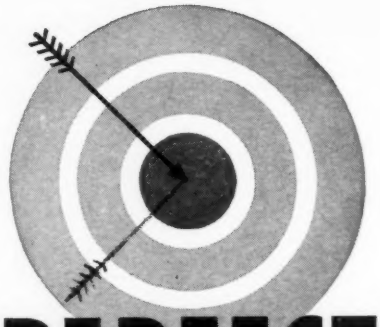
As a result of these findings, insecticide-treated asphalt as a combination vapor- and termite-barrier is being tested in further field experiments by UCLA. In these tests, the insecticide-treated asphalt emulsions are applied to areas inside the foundation, and a 1-inch layer of cinders or sand is placed on the ground in earth-filled extensions of the foundations, such as patios and porches.

A resume of Pence's experiments is contained in the Journal of Economic Entomology, October '57, Vol. 50, No. 5, pp. 690-92.

Powder-Post Beetle Booklet

"A Revision of The New World Species of Powder-Post Beetles Belonging to the Family Lyctidae," 55-page technical bulletin containing special appendix with 14 plates of Lyctid anatomical drawings, is available for 35c from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Called Technical Bulletin No. 1157, the booklet was written by PCO Dr. Eugene J. Gerberg, Insect Control & Research, Inc., Baltimore, Md.

The booklet covers Genus **Lyctus** Fabricius, Genus **Minthea** Pascoe, Genus **Lyctoxylon** Reitter, Genus **Trogoxylon** LeConte, and Genus **Phyllyctus** Lesne.



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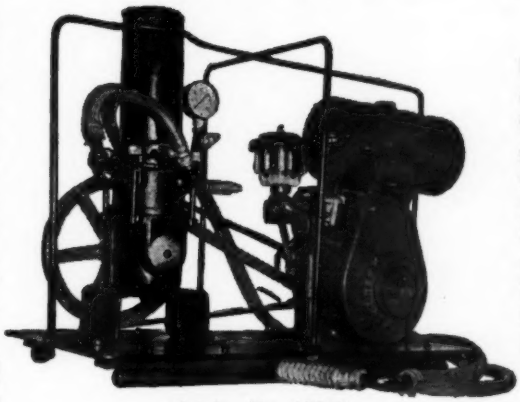
A NEW Portable Spraying & Termite Treating Unit With A Pump That Does Away With Your Pumpaches

NEW DIAPHRAGM PUMP Eliminates expensive break - downs, can be repaired on the job in less than ten minutes with extra kit which comes with each unit. Unit comes fully equipped with 100 Ft. 3/8" I. D. chemical hose & Accessories. Wt. Approx. 145 lbs.

Complete line of Electric and Gasoline Powered Portable Sprayers, Accessories & Tools, etc.



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Portable unit shown handles abrasive & corrosive chemicals used in termite, pest, weed & grass control applications without damage to pump's pumping parts. Capacity 6 gal. per minute, pressure adjustable to 175 P.S.I. Agitates 55 gal. steel drum of solution thoroughly.

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PORTABLE FUMIGANT T/C INSTRUMENT

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* Determining concentrations in air

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What's NEWS In The Industry

USDA Tests Newly-Discovered Low-Toxicity Insecticides

New, reportedly effective insecticides that appear less toxic to warm-blooded animals than any now in general use have been discovered by U. S. Department of Agriculture chemists at Beltsville, Md. working in a program to find insecticidal chemicals which leave no harmful residue.

Results of limited toxicity tests with the new compounds and preliminary trials to determine their effectiveness as insecticides have justified application for a public service patent on them, the USDA says. However, efficient methods of manufacture must still be worked out before the chemicals are available at reasonable cost.

The new insecticides are derivatives of chrysanthemumic acid. This acid makes up a part of the molecules of pyrethrum and allethrin, the two insecticides many consider safest on the market.

The USDA says acute toxicity tests on warm-blooded animals revealed the new compounds are only one-eighth as toxic as pyrethrum and one-third as toxic as allethrin. And in preliminary laboratory tests on insects, two of the new compounds were shown to be equal to or better than either pyrethrum or allethrin at high levels of kill, although somewhat slower in "knockdown," according to the Federal researchers. Both were reportedly less effective as insect killers than DDT or other hydrocarbons, all of which may leave toxic residues.

The new materials are said to be effective against the body louse and larvae of the common malaria mosquito, codling moth, and salt marsh caterpillar.

Pacific NW PCOA Program

Talks on termite, rodent, weed, and stored products insect control have been slated for the Ninth Annual Conference of the Pacific Northwest Pest Control Operators Association, March 2-5 at Imperial Hotel, Portland, Oreg.

Speakers scheduled are Oregon State College's Dr. William Furtick, Dr. H. Talford, Robert Every, and Ralph Beck (Extension Agent); Wayne K. Davis, Ailing House Termite Inspection Bureau, Oakland, Calif; Dr. Philip J. Spear, Technical Director of the National Pest Control Association; Fred Switzer, Executive Secretary of Pest Control Operators of California, Inc.; Dr. William Durham, U. S. Public Health Service Toxicology Laboratory, Wenachee, Wash.; LaVerne Miller, Oregon State Board of Health; G. H. Hansen, U. S. Fish & Wildlife Service, Portland, Oreg.; Larry Harmon, Geigy Agricultural Chemicals Co., Ardsley, N. Y.; Ben Culver, Krishell Laboratory; Lee Sturges; William Senske, Chemical Weed and Pest Control, Spokane, Wash.; Karl Hassler, Neil A. Maclean Co., Los Angeles, Calif.; Don Whitaker, Industrial Fumigant Co., Portland; Ray Dewey, Dewey Products and Pest Control Co., Los Angeles; and Donald Sloan, a Portland investment broker.

Registration details can be obtained from Conference President C. W. Fisher, Paramount Pest Control Service, 5207 N. E. Portland Highway, Portland 13, Oreg.

A public education display set up recently at the annual Perth (Western Australia) Royal Show, by Household Pest Control, Ltd., of Perth, caught the interest of thousands during the exposition's four-day run. In the picture above taken of the exhibit, note the termite tubes of **Nasutitermes** in the lower right hand corner. HPC's Frank Bonney said the Royal Show compares to a state or county fair in the U. S. and stimulates equally as much interest.

Georgia PCO Short Course

Nearly 100 persons were on hand in Athens, Ga., January 30-31, for the Second Annual Georgia PCO Short Course, sponsored by the University of Georgia, Georgia Pest Control Association, and Independent Pest Control Operators Association of Georgia.

Speakers included the university's Dr. J. J. Paul, Dr. George E. Thompson, and R. H. Driftmier; Theodore Oser, Oser Pest Control, Atlanta, Ga.; L. C. Whitehead, U. S. Fish & Wildlife Service, Raleigh, N. C.; Hamilton Laudani, Agricultural Marketing Service, USDA, Savannah; Dick Wright, B & G Co., Plumsteadville, Pa.; Jerry Goodman, B. & D. A. Weisburger, New York, N. Y.; J. W. Kirkpatrick, U. S. Public Health Service, Savannah; W. E. Blasingame, Georgia Department of Entomology, Atlanta; and J. Q. Maxwell, Curtis Circulation Co., Atlanta.

New quarters for Newsom Termite and Pest Control of Birmingham, Alabama is the low ranch-type brick building pictured above. Since this picture was taken a few weeks ago, W. J. Newsom, owner and operator, has acquired another truck for his service fleet and has added 30 feet to the rear of the building to give him more storage space for equipment.

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Join the many satisfied P.C.O.'s that are reporting excellent rodent control with HOPKINS WARFARIN PELLETS. Satisfied customers are our best recommendations. Depend on HOPKINS for quality products to assist you with your local problems. Plan now to cash in on profitable lawn insect — crab grass control this spring and summer. INQUIRE ABOUT **HOPKINS** GREEN LAWN INSECTICIDE also WRITE FOR DETAILS ON OUR NEW CRAB GRASS CONTROL.

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AGRICULTURAL CHEMICAL CO.
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FDA Clarifies Use of Methoxychlor in Dairies

The U. S. Food & Drug Administration has ruled against direct spray application of methoxychlor on dairy cattle but still approves spray applications for dairy barns and methoxychlor dust treatments for hornfly control on livestock.

The FDA's action against methoxychlor sprays on dairy cattle came in response to a petition from E. I. du Pont de Nemours & Co., Wilmington, Dela., requesting a tolerance of 0.25 parts per million for methoxychlor in milk to permit use of the pesticide as a fly spray on dairy cattle. The FDA ruled that no insecticide residue would be permitted in milk.

Studies have demonstrated, the FDA said, that when methoxychlor is applied as a spray to cattle, a slight residue will be evident in the milk, but when it is applied properly as a dust to the backs of cattle, the milk is not affected.

USDA entomologists claim such dust treatments afford excellent control of hornflies on cattle. Recommended dosage is 1 tablespoonful (about 10 grams) of 50% methoxychlor powder to each animal. This is sprinkled over the back and rubbed lightly into the hair. Such treatment, the Government says, will provide hornfly control for about three weeks. Federal researchers caution, however, such methoxychlor treatments will not control lice, other biting flies, the house fly, or ticks on the cow.

Some Dicapthon Available

Limited quantities of Dicapthon, new phosphate group insecticide, are available for experimental use by PCOs only. It is said to be effective against resistant German roaches and houseflies.

Developed by American Cyanamid Co., an emulsion Dicapthon concentrate containing about 24% active ingredient is being prepared for sale to PCOs by Agricultural Specialties, 10219 Denton Drive, Dallas 20, Tex. Write Ag. Specialties for details.

Calendar

Pacific Northwest Pest Control Operators Assn. Ninth Annual Conference, Imperial Hotel, Portland, Ore., March 2-5.

Iowa Pest Control Assn. Spring Meeting, Student Union Building, Iowa State College, Ames, March 6-7.

Fifteenth Annual Convention of the Pest Control Operators of California, Inc., Fresno Hacienda, Fresno, March 6-8.

Central Midwest District Pest Control Meeting, Town House Hotel, Kansas City, Kans., March 10-11.

New York Pest Control Assn. Meeting, Warwick Hotel, New York, N. Y., March 25, 7 p.m.

Michigan Pest Control Operators' Assn. — Wolverine Pest Control Assn. Spring Conference, in cooperation with Michigan State University, Kellogg Center, MSU, East Lansing, March 20-21.

Thirteenth Annual Conference of the North Central Branch of the Entomological Society of America, Sheraton-Jefferson Hotel, St. Louis Mo., March 26-28.

CDC Insect Control Operational Training Course, Purdue University, Lafayette, Ind., April 7-11.

Sixteenth Annual Canadian Pest Control Operators Conference, Queen's University, Kingston, Ontario, April 17-19.

Western Agricultural Chemicals Assn. Meeting, Hotel Biltmore, Los Angeles, Calif., April 22.

Chemical Specialties Manufacturers Assn. Mid-Year Meeting, Netherlands Hilton Hotel, Cincinnati, O., May 19-21.

knock-out the odor in Insecticides and other strong-smelling Chemical Specialties with CHLORSCENT

CHLORSCENT was especially developed to quickly, efficiently and economically cover and neutralize the unpleasant odors so often present in insecticides and other chemical specialties used in pest control operations. Why not test CHLORSCENT in your own products. We'll be glad to send a free sample on request, or ship you a pound at the low, low price of $1.80

deodorize 1 gallon of insecticide for only 2½ cents

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Your Formulations Go Further when You Fog with DYNA-FOG!

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Weighs 100 lbs.

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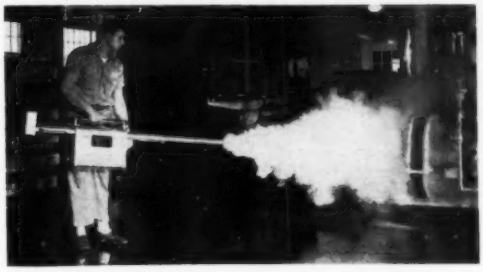
15 or 55 gal. Tank Capacity

Selective fog particle size from 0.5 to 75 microns. Only 3 moving parts. No lubrication needed.

Use Regular Grade Gasoline



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Weighs Just 19 lbs.

Dyna-Fog Jr. is "just the ticket" where portability is required: Drive-ins, Industrial Plants, Schools, Restaurants, General PCO work, Inside and Outside. Automatic formulation safety shut-off valve. Adjustable fog particle size from 0.5 to 50 microns. Extremely high velocity air flow. Complete with hand air pump and starting batteries. 2 gal. tank capacity.

Both machines all-metal construction. Rust-proof

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Our "Loan Service Machine" program guarantees you'll never be without Dyna-Fog or Dyna-Fog Jr. during the entire life of the machine you buy.

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NEW AER-O-MATIC ELECTRIC DEODORIZER

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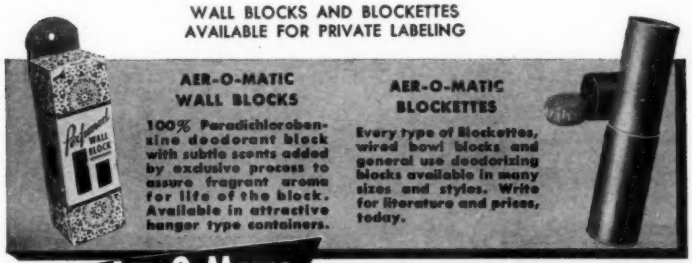

AER-O-MATIC WALL BLOCKS

100% Paradichlorobenzine deodorant block with subtle scents added by exclusive process to assure fragrant aroma for life of the block. Available in attractive hanger type containers.

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Every type of Blockettes, wired bowl blocks and general use deodorizing blocks available in many sizes and styles. Write for literature and prices, today.

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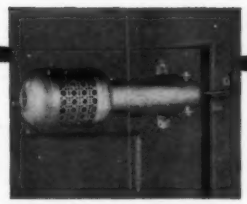

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Infestation Report

Contains pertinent portions of the Department of Agriculture's **Cooperative Economic Report**, material from university entomology departments and reports from readers. PCOs noticing infestations in their own areas are urged to communicate with Pest Control so their information may be added to this infestation report.

BED BUG
(Cimex lectularius)

Maryland: Troublesome in home at Hyattsville and also in Rockville.

BLACK WIDOW SPIDER
(Latrodectus mactans)

Virginia: Found in basement of home in Radford.

BOXELDER BUG
(Leptocoris trivittatus)

Maryland: Causing nuisance by entering homes in Baltimore. **Utah:** Invading a number of homes at Spanish Fork, Utah County.

BROWN DOG TICK
(Rhipicephalus sanguineus)

Delaware: Troublesome in home, northern New Castle County. **Maryland:** Adults found in home at College Park, Prince Georges County.

CLOTHES MOTH

Utah: Damaged stored woolen clothing and a carpet at Hyrum, Cache County.

CLOVER MITE
(Bryobia praetiosa)

Georgia: Large numbers on walls of four institutional homes, De Kalb County. **Virginia:** Very heavy around windows of home in Bedford County.

COCKROACHES

Georgia: Heavy infestation of Blattella germanica in large apartment building, Atlanta. **Virginia:** Periplaneta americana heavy in a home in Vienna.

A DERMESTID
(Perimegatoma vespulae)

California: Light in sacks in Kern County and heavy in barrel of mixed corn and beans, Riverside County. These finds constitute fourth and fifth records in State, as far as known.

FIRE ANT

Alabama: New records of Solenopsis saevissima richteri in Calhoun, Lamar, Limestone, and Talladega Counties. **Florida:** Solenopsis saevissima richteri found in two new townships, Gadsden County. Collected in sweep net while sweeping for other insects near Archbold Biological Station, Highlands County. Collected at Bay Springs, Escambia County. Four new infested properties 4½ to 6½ miles west of Clarksville, Calhoun County. New county records: Gulf, Washington, and Marion Counties. **Georgia:** Survey of Solenopsis saevissima richteri in Decatur County showed 107,133 acres infested, of which 22,240 acres have been treated by plane and 1,568 by ground equipment. New records for state: Muscogee, Chattachooche, Marion, and Peach Counties. **Louisiana:** New records of Solenopsis saevissima richteri in Madison and Tangipahoa Parishes. About 285,000 acres surveyed in 29 parishes and about 6,052 treated in 16 parishes. **Mississippi:** Solenopsis saevissima richteri survey revealed large infestation in Madison County, which is distantly removed from previously infested areas. **South Carolina:** New records of Solenopsis saevissima richteri for state: Berkeley and Marion Counties. **Texas:** Solenopsis geminata reported from Burleson, Brazos, Waller, Montgomery, Harris, Robertson, Lavaca, Liberty, Bexar, Grimes, Wharton, and Hidalgo Counties.

KHAPRA BEETLE
(Trogoderma granarium)

Arizona: Six infestations, two each at Buckeye and Phoenix in Maricopa County, one each at Parker and Vicksburg in Yuma County. **California:** Three new infestations: two in Kern County, one in Imperial County. **Colorado, Idaho:** Inspections negative. **Mexico:** Three new properties reported infested in Mexicali district. **Oregon:** Inspection reported negative.

OLD HOUSE BORER
(Hylotrupes bajulus)

North Carolina: Large numbers emerging through pine paneling and pine subflooring into Wake County home.

A SPIDER BEETLE
(Ptinus gandolphei)

California: Medium infestation in bathroom, Tulare County, is apparently third record for state.

KOLKER METHYL BROMIDE

Now being produced at our modern plant in Newark, N.J., Kolker Methyl Bromide is the outstanding fumigant for the elimination of insect and rodent infestation of grain, tobacco plant beds, seeds, dried fruits, cereals, nursery stock and a wide variety of other products.

KOLKER METHYL BROMIDE

- Kills insects, mites and related pests in all stages of their development.
- Has a high degree of toxicity to a wide range of insects, rodents and other pests.
- Has rapid volatilization and a high rate of diffusion into stored grain, bales, packages and soil.
- Is non-explosive and non-flammable.
- Does not leave any residual odors, tastes or stains.
- Is economical to use.

KOLKER Methyl Bromide is packaged in one-pound cans, packed 24 per case for domestic shipment and 48 per case for export.

It is also available in cylinders of 50, 100, 150 and 450 pounds net capacity.

KOLKER Methyl Bromide may be ordered as a 100% product or with 2% chloropicrin warning agent.

For further information on this highly effective fumigant, please call or write us today.

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Primer

How's Your Vocabulary?: 3

Time for another PCO word-game on common entomological expressions. Terms and their definitions below, prepared by the Entomology Department at Purdue University, have been juggled out of order by PC's editors to test your knowledge of technical words with which all operators should have a speaking familiarity. From the 13 alphabetically-listed definitions at the bottom of this page, pick the ones you think best fit each expression numbered immediately below and insert the identifying letter of the definition in the blank space opposite the expression. Then check page 66 to see how well you did. A pronunciation guide, provided by PC's editors in cooperation with the Cleveland Public Library, is carried in italics under each word. Capitals indicate where emphasis is placed.

1. ___castes *(kasts)*
2. ___caterpillar *(KAT er pill er)*
3. ___cercus *(SUR kus)*
4. ___chemotropism *(kay MAHT roh-piz'm)*
5. ___chitin *(KIGH tin)*
6. ___chrysalis *(KRIS a lis)*
7. ___classification *(klas eh feh KAY sh'n)*
8. ___co- (prefix) *(koh)*
9. ___cocoon *(kuh KOO'n)*
10. ___coprophagous *(kop RAHF a gus)*
11. ___copulate *(KOP yoo layt)*
12. ___cycle *(SIGH k'l)*
13. ___dendrophagous *(den DRAHF a gus)*

(a) in general, the larva of Lepidoptera; in Hymenoptera, the larvae of the saw-flies.

(b) the various forms or kinds of grouped matured individuals among social insects, as workers, soldiers, queens, etc.

(c) the systematic arrangement of insects (or other animals or plants) in a series showing their relation or agreement in structure, life habits, or other characteristics.

(d) a colorless nitrogenous polysaccharide, a chemical compound intermediate between proteins and carbohydrates; the chemical formula (Brach,1912) is $(C_{32}H_{54}N_4O_{21})x$; a secretion of the epidermis; applied to the hard parts (external skeleton) of the insect body.

(e) an appendage (generally paired) of the tenth abdominal segment, usually slender, filamentous, and segmented.

(f) a round or circle, e.g., of development; a life cycle.

(g) feeding on woody tissue.

(h) feeding on excrement or on decaying vegetable matter of an excrementitious character.

(i) applied specifically to the intermedial stage between larva and adult in butterflies.

(j) a form of con; together; e.g., coadapted; formed so as to work together to one end.

(k) a covering, composed partly or wholly of silk or other viscid fiber, spun or constructed by many larvae as a protection to the pupa.

(l) to unite in sexual intercourse.

(m) reaction to chemical stimuli, i.e., smell and taste.

Answers on page 66

MSA Issues Glove Booklet

An attractively-illustrated, two-color bulletin, describing in detail its complete line of protective gloves and finger cots, has been issued by Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.

The eight-page Bulletin 1310-2 also features a guide showing comparative physical characteristics and relative resistance of MSA's five types of molded rubber and synthetic glove materials to common chemicals.

Handle more business . . .

Enjoy bigger profits

with John BEAN lawn care sprayers

for: WEEDING
- FERTILIZING
- TURF DISEASE and LAWN INSECT CONTROL
- FLY and MOSQUITO CONTROL

TRAILER MOUNTED Model 44

You'll increase your profits in the lucrative turf spraying business with John Bean equipment. Built for long service at low cost and designed to give you more efficient chemical application. John Bean Sprayers feature big capacity, compactness and ease of operation that no other sprayer can provide.

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30 Gallon Portable

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John Bean Spartan and Trojan portable units give you high pressure power spraying at low cost with the mobility to handle small area spraying faster and easier.

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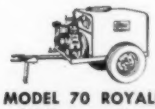
Sanitation Sprayer

ROTOMIST
Shade Tree Sprayer



MODEL 70 ROYALETTE
All-Purpose Sprayer

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SAN JOSE, CALIFORNIA
Division of Food Machinery and Chemical Corporation

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[ ] Facts on Dutch Elm Disease Control
[ ] Mosquito Control Costs
Attach Coupon to Card or Letterhead — Give Name and Address

Lab Tests Indicate Sesoxane Strengthens Methoxychlor

Laboratory results indicate a synergist effective with pyrethrins also improves insecticidal efficiency of methoxychlor, according to Dr. H. E. Fairchild, research entomologist at E. I. duPont de Nemours & Co., Wilmington, Del.

Speaking to members of the Chemical Specialty Manufacturers' Association at their 44th annual meeting recently, Dr. Fairchild described laboratory experiments in which methoxychlor was synergized at various rates with "Sesoxane" trade name for 2-(2-ethoxyethoxy) ethyl 3,4-methylene-dioxyphenyl acetyl of acetaldehyde. He said experimental applications provided "excellent" control of German roaches for which methoxychlor alone has not been considered effective, and substantially improved control of the Roberds strain of house flies resistant to chlorinated hydrocarbons.

In addition, the synergist was said to improve methoxychlor control of black carpet beetles, confused flour beetles, and granary weevils.

All treatments reported by Dr. Fairchild were applied as contact sprays of acetone solutions, and conclusions were based on per cent kill in a 24-hour period.

In one test, a formulation containing 1% Sesoxane and 2% methoxychlor reportedly gave 98.3% kill of German roaches in 24 hours, compared with 1.7% kill for a 1% solution of Sesoxane alone and 13.3% for a 2% methoxychlor solution.

If this laboratory work with contact sprays is confirmed for residual effectiveness, and they are developed commercially, Dr. Fairchild said it means a substantial advancement in combining control activity against both flying and crawling insects in households. Both methoxychlor and Sesoxane are said to have a low order of toxicity to men and animals.

The compound is being manufactured in pilot plant quantities by Shulton, Inc., Clifton, N.J. Plans are underway at Shulton for large-scale commercial production.

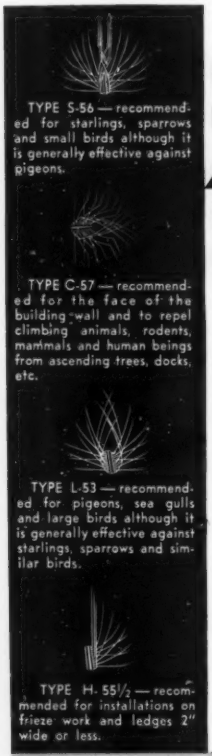
$250,000 Rat Bite Suit

A four-month son of Mr. and Mrs. Henry Collins of Harlem, New York has been "crippled for life" after a rat chewed off the entire muscle of his right leg while the infant slept in his bed in a rat-infested tenement house. The victim's parents have sued the landlord, William McKinley Memorial Hospital of Trenton, New Jersey, for $250,000, charging gross neglect in the care of the building.

The child, Keith Collins, was so severly bitten the entire right leg muscle was chewed off and his right arm was permanently dislocated. Both legs and several toes also were bitten.

CDC Rodent Handbook

The CDC Training Handbook "Control of Domestic Rats and Mice" (PC, Aug. '57, page 18) has been printed by the Government Printing Office and is available for 25c a copy from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.


TYPE S-56 — recommended for starlings, sparrows and small birds although it is generally effective against pigeons.
TYPE C-57 — recommended for the face of the building wall and to repel climbing animals, rodents, mammals and human beings from ascending trees, docks, etc.
TYPE L-53 — recommended for pigeons, sea gulls and large birds although it is generally effective against starlings, sparrows and similar birds.
TYPE H-55½ — recommended for installations on frieze work and ledges 2" wide or less.

NIXALITE® BIRD BARRIER NOW OFFERS 4 TYPES FOR MAXIMUM REPEL-ABILITY

Your specific bird problem — your building and its structural features — these all-important factors determine the correct Nixalite installation to banish birds from your building permanently. Nixalite, the man-made porcupine, with its myriads of needle-sharp springy stainless steel prongs, keeps birds flying. **Lasts a lifetime, yet pays its own way in just one year.**

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1722-26 First Avenue **Rock Island, Ill.**

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2. **Quality built to assure low maintenance.**
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Each unit covered by $100,000 product insurance. Exclusive feature assures uniform heat dispersion and constant vaporization. Check the Uni-Vap, most reliable in the field, before you buy.

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1 lb. cans
Write for new lower prices and literature.

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P.O. Box 3216 4200 So Mendota St.
Madison 4, Wisconsin

Eastern Conference

(from page 46)

nating Co., Hartford, Conn.; Herman Ratner, Ratner Pest Control, Atlantic City, N. J.; and Russell J. Rowlett, Jr., Virginia Carolina Chemical Co., Richmond, Va.

Special Safety Program

Tied in with these panels on insects, rodents, and proper application of chemicals, was a special session on safety.

"There are three factors controlling the accident experience of a PCO," Jerry Goodman of B. & D. A. Weisburger Co., New York, N. Y., told conferees. "These are your management or supervisors, the drivers of your service vehicles, and the equipment they use."

Goodman added that a PCO formulating a safety program for his servicemen will have to decide on minimum precautions for certain hazardous jobs, "but can there be a maximum?"

Other safety talks were heard from Dr. E. H. Wheeler, Extension Professor, University of Massachusetts; William Turrie of Wil-Kil Co., Milwaukee, Wisc., chairman of the NPCA Safety Committee; Dr. Edward Press, American Public Health Association, Inc., New York, N. Y.; and George Perry, an insurance safety engineer.

Dr. Spear wound up the conference with a review of new chemicals. (See resume included in Purdue Conference report, page 36 of this issue.)

SURE Kill every time

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...provides accurate on-the-spot measurements of methyl bromide concentrations from any number of test areas inside the volume being treated.

Accurate to two oz. per 1,000 cubic ft., this scientific instrument is completely self-contained and will provide years of trouble-free operation. Available in portable battery-powered units (shown above) and in standard 115 volt A.C. models. WRITE TODAY FOR COMPLETE DETAILS.

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MASK THAT ODOR!

Your pest control chemicals may be the most effective materials on the market. But if they have an odor that is at all objectionable, *then you've a need for what we offer*—which is easy, economical, practical control of that odor through the use of low cost, laboratory-developed neutralizers. As pioneers and specialists in the industrial odorant field, we are in a position to advise and guide you in the selection and use of odor neutralizers best suited to your particular product. Therefore, if you'll send us a small sample for experimental purposes, we shall be happy to study it carefully and forward you recommendations, samples and quotations for an efficient job of odor masking. Your use of this service is invited with our usual "no obligation" understanding. Please mention this publication when writing.

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This amazing FUMO-KILL insecticide is by all qualifications a leader in its field.

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EASY TO USE: Requires no Special Equipment.

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FUMO-KILL is truly the modern method of insect extermination. Light match to contents of can, will produce fumes—NO FLAME. Non-hazardous. This amazing FUMO-KILL insecticide has been tested, and found effective against most types of household pests.

FUMO-KILL can be obtained in 2 oz. (enough for up to 6,000 cubic feet)—4 oz. and 1-lb. cans.
Cost of 12—2-oz. Cans.....$ 7.50 per doz.
Cost of 12—4-oz. Cans..... 13.50 per doz.
Bulk ..... 4.50 per lb.

Delivery Charges Prepaid

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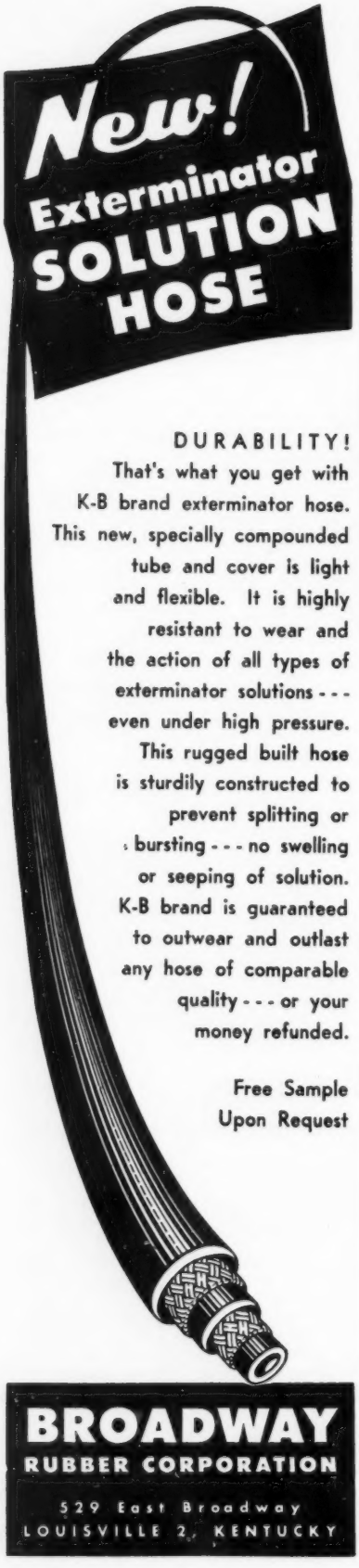

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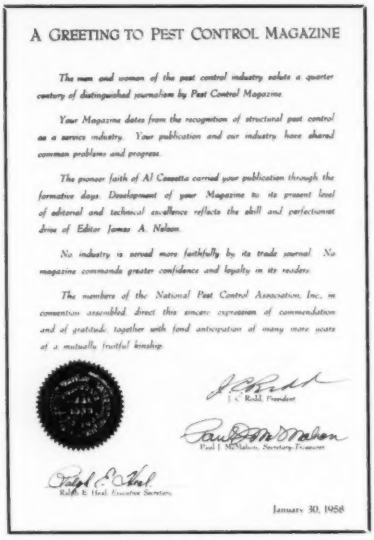
NPCA, Purdue Cite PC's 25th Anniversary

A special citation was made to Pest Control magazine, in recognition of its 25th anniversary, by the National Pest Control Association in January during the Purdue PCO Conference.

NPCA past president C. Norman Dold, of Rose Exterminator Co., Chicago, handed the handsomely framed plaque, after reading its message of congratulations, to PC's editor and publisher James A. Nelson at a surprise presentation before over 400 delegates during the conference's annual banquet, January 30. Shortly before, J. J. Davis, professor emeritus of entomology, presented Jim Nelson with a Purdue University 15-Year Attendance Certificate recognizing the publication's continuous participation in the university's PCO conference. It is the first time such a recognition has been made by Purdue to any individual, supplier, or magazine.

Authorization for the NPCA's citation was given by the association's Board of Directors at last year's convention, but kept secret until the time of presentation. Headed, "Greeting to Pest Control Magazine," the plaque reads:

> The men and women of the pest control industry salute a quarter century of distinguished journalism by Pest Control Magazine.
>
> Your Magazine dates from the recognition of structural pest control as a service industry. Your publication and our industry have shared common problems and progress.
>
> The pioneer faith of Al Cossetta carried your publication through the formative days. Development of your Magazine to its present level of editorial and technical excellence reflects the skill and perfectionist drive of Editor James A. Nelson.
>
> No industry is served more faithfully by its trade journal. No magazine commands greater confidence and loyalty in its readers.
>
> The members of the National Pest Control Association, Inc., in convention assembled, direct this sincere expression of commendation and of gratitude, together with fond anticipation of many more years of a mutually fruitful kinship.
>
> (NPCA Seal) J. C. Redd, *President*
> Paul J. McMahon, *Secretary-Treasurer*
> Ralph E. Heal, *Executive Secretary*
> January 30, 1958



A GREETING TO PEST CONTROL MAGAZINE

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J. C. Redd, President

Paul J. McMahon, Secretary-Treasurer

Ralph E. Heal, Executive Secretary

January 30, 1958

Founded in January 1933, Pest Control magazine is celebrating it's Silver Anniversary during 1958. The National Pest Control Association, which organized in October 1933, will mark its own 25th anniversary during the NPCA annual convention at the Statler Hotel in Washington, D. C., October 19-23 this year.

Suppliers' Staff Changes

Three new appointments have been announced by the Velsicol Corp., Chicago, Ill. **Kenneth L. Schulz** has been made technical sales representative for Indiana and Illinois; **B. Gene Carter**, technical sales representative for Ohio, Kentucky, Michigan, West Virginia, and western portions of Pennsylvania and New York; and **Richard E. Noonan**, a Marketing Specialist. Schulz is headquartered in Lincoln, Ill.; Carter in Columbus, O.; and Noonan, in Chicago.

Robert P. Harrison and **John R. Fisher** have been appointed field specialists in the agricultural chemical development for The Dow Chemical Co., Midland, Mich. Harrison will work out of Washington, D. C., and Fisher, from Seattle, Wash.

Answers to Primer
on page 63

1. (b) **2.** (a) **3.** (e) **4.** (m) **5.** (d) **6.** (i) **7** (c) **8.** (j) **9.** (k) **10.** (h) **11.** (l) **12.** (f) **13.** (g)

Notebook

TIPS AND IDEAS FROM THE FIELD

Rat Tubes

By Maurice Landers
Rose Exterminator Company
Cleveland, Ohio

Owners of a plush home in one of Cleveland's wealthier neighborhoods were more than upset when they discovered a family of five Norway rats was visiting their basement.

Called to investigate, I made a thorough study of the premises and particularly the basement, where activity was decidedly heaviest. But I could not determine right away where the rats were coming from or going to when they passed in and out of the house. A large wood pile at the rear of the furnace in the basement looked like a possible trouble-spot. It covered a drain that had been used for a refrigerator drain tube.

There were tiny drains in window wells outside the mansion, drains which were connected to the one in the cellar. The rats had been able to flip the window well drain lid back, squeeze in, and scurry through to the basement.

Red squill baits in a corn meal mixture placed around the wood pile, stopped the five rats. With both the outside drain opening and the basement drain cover secured, the owners had no more rodent troubles.

For Skunk Odors

Neutroleum Alpha, available from Fritzsche Bros., Inc., 76 Ninth Avenue, New York 11, New York, is said to be effective in ridding a premises of skunk odors.

You're Fully Protected

when you obtain your

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Our policies will cover claims which arise from damage to property in your Care, Custody and Control. Also covers completed operations.

You get 43 Years of Specialized Experience in Rodenticide and Insecticide Coverage

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If You Weren't Able To Attend Our Spraying Equipment Show & Service School

PCOs who did attend saw the latest spraying equipment, learned sprayer maintenance and discussed new methods to build PCO sales with low-cost power spraying equipment.

If you were unable to attend and would like complete information on sprayers write us today. We'll be happy to tell you about Hollandia's power sprayer department. And don't forget, Hollandia is a distributor for Ortho Products. More and more PCOs rely on Hollandia for personal service on chemicals and equipment. Write us today to learn how Hollandia can serve you.

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South Vienna, Ohio

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"For 70 Years Choice For Quality The World Over"

Streamlined BLIZZARD Copper Continuous Sprayer

World's most beautiful copper, continuous sprayer. Pt. and Qt. (39 ounce) sizes. Glistening, solid copper tank. Pump barrel is highly polished, seamless brass. Modern design. Sturdy construction. Twin nozzles for spraying fine fog mist straight ahead or at any angle. Sprays any liquid.

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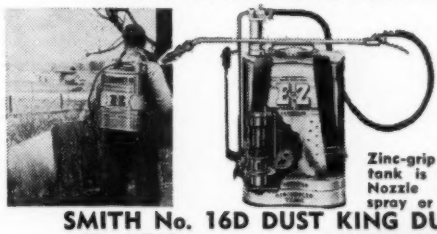

Finest knapsack sprayer made. Pump lever developes powerful pressure. Seamless brass pump. Brass valves. Zinc-grip steel or copper tank is air conditioned. Nozzle adjustable for spray or long stream.

SMITH No. 16D DUST KING DUSTER

(Quart Size)

Precision built. Long extension tube. Non-clog nozzle is adjustable. Easy working plunger assures even dust blast. Popular for every dusting purose.

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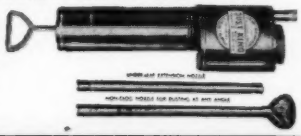

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End RAT BAIT SHYNESS

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READY-MIX BAITS

Now you can get complete rat and mouse clean-outs with just one bait, Eaton's A-C, available in 4 different flavor attractants.

Eaton's A-C is a new, insect and mold resistant anti-coagulant formula that features Fumarin blended with 19 taste-tempting ingredients.

PCOs report complete success by keeping acceptance high through alternating usage of these 4 available flavors . . .

Meat, Fish, Coconut, Molasses

Write today for details.

Only 24¾c lb. F.O.B. Cleveland
in 100 lb. quantities
Packed in 50 lb. containers

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5 YEAR GUARANTEED

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Not only will you increase the scope of your present operation, but the potential of new customers will widen your field and help to increase your overall business. 5 Year Guaranteed Moth Chek has been proven effective by numerous independent laboratory tests* and protects against the ravages of moths and carpet beetles.

Now available — a complete line of pesticide chemicals - Diazinon - Chlordane - DDT - Pival - Warfarin - Thallium Sulphate - Zinc Phosphide and many others.

Flame Chek flameproofing service is now available to PCOs. Flame Chek protects carpets, draperies, curtains and upholstery. Field is unlimited - schools, offices, theatres, nite clubs, hotels, motels and homes are all potential users of this service.

WRITE FOR COMPLETE INFORMATION

*Test results available on request.

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When answering ads where box number only is given, please address as follows: Box number, c/o Pest Control, 1900 Euclid Avenue, Cleveland 15, Ohio.

Rates: "Position Wanted" 5c per word, minimum, $1.00. All other classifications, 10c per word, minimum $2.00. All classified ads must be received by Publisher the 10th of the month preceding publication date and be accompanied by cash or money order covering full payment.

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SUPERVISOR: Employed in responsible position with present firm over 15 years desires to relocate in Florida or other warm climate. Understand all phases of pest control — estimating, selling, hydrocyanic acid, and methyl bromide fumigation—termite control, regular service work. Can supply excellent references and will furnish photo and pertinent details on request. Box 453, Pest Control magazine.

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OPPORTUNITIES UNLIMITED. The world's largest pest control organization (AAA-1 rated) has interesting openings for men with initiative and ambition. We operate in 28 states from coast to coast and there are opportunities open in many phases of our operation . . . servicemen, managers, technical representatives and salesmen. Experience in professions related to pest control helpful, though not necessary. Liberal salary and incentive arrangements provide unparalleled opportunities for men with good judgment and the ability to get along with people. Our firm, over 50 years old, offers employee benefits including paid vacations, sick leave, life insurance, hospitalization and pension plan. All replies confidential. Interviews in Atlanta at our expense. Write in detail to Orkin Exterminating Company, Inc., 713 Peachtree Street, N.E., Atlanta, Ga. Attention: Personnel Dept.

IMMEDIATE OPENINGS for pest control operators, with "top" experience, in our Caribbean offices. Permanent and temporary positions available. High salaries, maintenance and transportation furnished. Unusual opportunities. Write or wire immediately L. L. Crosby, president, Commonwealth Sanitation Co., 3567 Bigelow Blvd., Pittsburgh 13, Pa.

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WILL PAY TOP PRICE for exterminating business in New York City area. Cash. Replies confidential. Box 439, Pest Control magazine.

FOR SALE

DYNA-FOG Jet Insecticidal Fog Generator Model DFG. Used one season. Perfect condition. 15-gallon tank. Extra Valve head, complete. Cost $1,165. First $500 takes. Industrial Chemical Co., 830 Ellis Ave., Ottumwa, Ia.

MISCELLANEOUS

DUE TO OTHER INTERESTS, small New York exterminating company wishes to merge with other small business on cooperative basis. Mr. Gold, UN 4-2100.

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Makes air Fresh as a Daisy

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The SCENT-FLO ELECTRIC FAN-OPERATED AIR FRESHENER IS THE SALES LEADER IN THE FIELD TODAY—THE FIRST AND STILL THE FINEST DEODORIZER ON THE MARKET! Sanitary operators report bigger profits and more repeat sales based on greater customer acceptance and the MONEY BACK GUARANTEE of the manufacturer — the originator of the electric fan-operated deodorizer. WRITE TODAY for full details on FREE trial offer for yourself or one of your customers.

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Pestales

Roach-nik. A panel of missile experts reports no form of life exists aboard the Army's Explorer satellite, but one authority admits there's a possibility a cockroach might have stowed away in it. *If they find one, you can be sure the Navy or Air Force had something to do with it.*

* * *

PCO grid mentor. Oklahomans are about football the way mice are about cheese. And Tom Graham of Graham Pest Control, Oklahoma City, apparently is no exception. This winter, Graham coached a Baptist Church team of boys 14 years and under (weight limit, a bantam 125 pounds), and his gridders won all their contests except the final, big one—the State Championship. Tom tells us he spent three hours a day with "his" boys for three months, and enjoyed every minute of it.

* * *

TO's skull-duggery. A couple of weeks ago, San Francisco servicemen Roland Harroun and Clyde Addington touched off an intensive homicide investigation after they uncovered a human skull and some bones while termiting around in an old basement. Apparently, however, the bones — they weren't human — had been buried in the basement by a dog and the skull by a medical student. *Now all the homeowner wants to know is who put the termites there.*

* * *

Industry leader's loss. Mrs. Clara Rose, wife of industry pioneer Daniel Rose, founder of Rose Exterminator Co., Los Angeles, Calif., died Feb. 1. Funeral services were held early last month in Glendale, Calif.

* * *

Rat hunt. Last month was "rat hunting" month in Osaka, Japan. For every rat a citizen turned in, he received a lottery ticket from the local government, entitling him to a chance at one of 133 prizes. *Best prize for the top winner would be a year's free pest control service.*

* * *

Would-Be PCO isn't. Then there's the St. Louis shoe salesman we were having coffee with at the Purdue Conference. Although he had no experience or particular aptitude to recommend him to this profession, he was convinced he could pick up enough tips at the Purdue Conference to open his own pest control business back home and "get by." He already had a rigged contract to safeguard him from complaints. After puzzling over the early technical sessions, however, he pulled out after the third day of the conference. Apparently he's back in St. Louis merchandising footwear. In this day of advanced pest control technology, it takes more than a twitch of ambition to make a good pest control operator.

* * *

Pest-proof? In Uganda, East Africa, they're offering pre-fab housing units with built-in ant-proofing. The walls have been treated with arsenic. *Now all's that's left are the lions, tigers, pumas, jaguars, ocelots, lynx, wild cats et al.*

* * *

Mark this. Young Mark J., son of Si Ratner of Ratner Exterminating Co., Washington, D. C., has joined his pop in the business. Guess there's no doubt Si's son will make his Mark in the world!

* * *

Strikers out, pests in. In Toledo, O., a large department store had to summon police when several members of a striking clerks union released a couple dozen mice and three pigeons in the store. *Bet there was a real "run" on doors that day.*

* * *

Convalescing. Harold E. Jennings, Smithereen Exterminating Co., Chicago, is now under doctor's care in his home recuperating from the extended illness that sent him to the hospital over a year ago. Harold was missed at the Purdue Conference this year. For industry friends who wish to write him, Harold's home address is 10929 Longwood Dr., Chicago 43, Ill.

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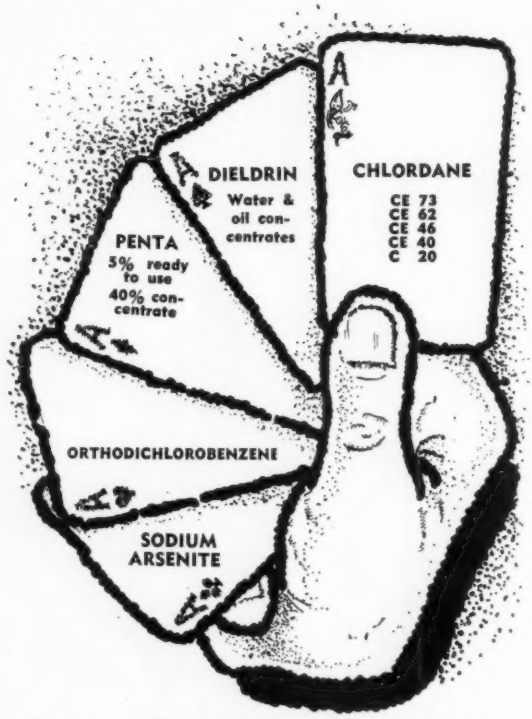

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